

BUSINESS

ARITHMETIC

THIRD EDITION

CURRY - RICE

15392

Wula Wilson
Woodbury
College -

B U S I N E S S A R I T H M E T I C

By

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THIRD EDITION
ABRIDGED

SOUTH-WESTERN PUBLISHING COMPANY

CINCINNATI

NEW YORK

CHICAGO

SAN FRANCISCO

ARTHMETICS
BUSINESS

PRESTON E. CURRY

RALPH R. RICE

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SOUTH-WESTERN PUBLISHING CO.

Cincinnati, Ohio

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P R E F A C E

The purpose of this book is to provide for a mastery of the fundamental operations and to develop accuracy and a reasonable degree of speed in the application of the fundamental operations to the various problems which may arise from activities and transactions in the home, the school, society, and business.

The authors have been painstaking in their search for interesting material which has a practical significance. Pure mathematics has been avoided as much as possible and is used only in developing principles which are to be applied to the solution of practical problems and business practice, which involve the use of forms.

Several units are devoted to fractions, common and decimal, in order to clarify as much as possible this rather obscure and difficult division of arithmetic.

Discussion problems are provided so that the student may understand arithmetic problems in their entirety: purpose, setting, and business value. It is not the purpose of the text to provide a course in business training or business administration, but to enable the student to see arithmetic in action. Mere problem-solving does not do this.

In the development of percentage and interest, the method is similar to that used in developing the fundamental operations; that is, principles are developed first and are applied later to the more complicated problems of the business man: banker, merchant, manufacturer, farmer, broker, and accountant.

Unit 9 deals with business practice. In this unit an effort has been made to select the most representative business situations, and all the problems are correlated with principles previously

developed in such a way that there is a direct application of fundamentals to the solution of problems involving several processes.

Throughout the text provision has been made for estimating answers according to the procedure set up by D. S. Newcomb in his book, "Modern Methods of Teaching Arithmetic."

The reason for revising the text is to bring it more thoroughly up to date in objectives, tools, contents, procedures, measurements of progress, mastery, and applied skills.

The authors are indebted to many teachers and other friends for their help in submitting problems and offering suggestions to the end that the text may serve a useful purpose. Those making the most material contributions are: Mr. M. E. Studebaker, who wrote the unit on rural problems; Mr. Paul L. Evans, who contributed the material on school banks; and Mr. Frank H. Glasson, who made a critical analysis of the previous edition.

P. E. C.

R. R. R.

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UNIT 1

ADDITION

CHAPTER 1

PRINCIPLES AND DRILLS

Accuracy and speed. The first essential in business arithmetic is accuracy, and the second is speed. The application of the principles is not sufficient for the business man unless the results are correct. The value of one's services to the business world will depend, to a great extent, upon his ability to apply accurately and quickly the fundamental operations of arithmetic to the solutions of business problems.

Addition. Addition is the process of finding the sum of two or more numbers and of expressing this sum in one number. The sum, or, as it is often referred to in business, the total, is the number which expresses the value of two or more numbers.

EXERCISE No. 1, COMBINING NUMBERS

Progressive addition gives excellent practice in combining numbers. The following drills provide oral practice in progressive addition. You are to add in each case to approximately 100.

1. Begin with 3 and count by 2's; 4's; 6's; 8's.
2. Begin with 2 and count by 3's; 5's; 7's; 9's.
3. Begin with 9 and count by 5's; 7's; 9's; 3's.
4. Begin with 7 and count by 4's; 6's; 8's; 2's.
5. Begin with 14 and count by 6's; 2's; 4's; 8's.
6. Begin with 19 and count by 7's; 3's; 5's; 9's.
7. Begin with 16 and count by 9's; 7's; 5's; 2's.
8. Begin with 11 and count by 8's; 2's; 4's; 6's.
9. Begin with 13 and count by 3's; 5's; 7's; 9's.
10. Begin with 14 and count by 7's; 3's; 5's; 9's.
11. Begin with 8 and count by 9's; 5's; 7's; 3's.
12. Begin with 5 and count by 7's; 3's; 5's; 9's.
13. Begin with 6 and count by 2's; 4's; 6's; 8's.
14. Begin with 4 and count by 5's; 3's; 7's; 9's.

EXERCISE No. 2, COMBINATIONS

The speed of adding a column of figures is increased when two or more figures are combined and are added to the others in one amount. Figures which amount to 10 when combined are recognized most easily. With practice, other combinations also can be recognized quickly.

$$\begin{array}{r}
 10 \left\{ \begin{array}{l} 85 \\ 25 \end{array} \right\} 10 \\
 12 \left\{ \begin{array}{l} 96 \\ 34 \end{array} \right\} 10 \\
 15 \left\{ \begin{array}{l} 84 \\ 73 \end{array} \right\} 7 \\
 13 \left\{ \begin{array}{l} 36 \\ 74 \end{array} \right\} 10 \\
 \hline
 507
 \end{array}$$

The method of combining the figures in each column is shown in the illustration at the left. The two figures are combined by brackets and the sum is indicated at the right or the left of the brackets. The mental process when the first column is added should be "10, 17, 27, 37." The 7 is written and the 3 is carried to be included in the first group in the second column. The process in the second column is "13, 23, 40, 50."

Add the columns in the following problems. So far as possible add two figures at a time. Practice on the problems until you can add them quickly and accurately.

a	b	c	d	e	f	g	h	i	j	k	l
16	46	36	47	36	24	38	63	14	23	33	37
92	83	14	23	74	56	72	47	26	87	72	51
85	37	93	72	75	38	75	57	78	68	28	42
63	83	17	38	67	72	35	68	46	97	34	14
23	89	85	36	41	75	41	43	94	36	48	33
87	21	65	74	69	35	69	77	82	74	92	23

EXERCISE No. 3, COMBINATIONS

Speed can be further increased by combining three or more figures in one group. Note the illustration at the left. Add the problems, combining three or more figures. Practice on the problems until you can add them quickly and accurately.

	a	b	c	d	e	f	g	h	i	j
10 { 27	15	42	12	24	44	89	95	31	31	69
10 { 32	63	12	34	82	97	31	24	82	45	13
10 { 51	14	32	33	16	41	25	12	34	29	75
10 { 21	33	68	48	12	32	54	74	44	44	22
10 { 24	21	73	66	74	45	32	21	67	89	96
10 { 67	66	15	32	12	52	47	61	12	38	23
10 { 96	23	22	12	24	13	85	28	31	42	41
17 { 23	82	86	48	59	98	55	23	96	25	75
17 { 31	74	14	65	33	56	21	39	43	51	63
372	54	19	23	24	62	34	95	28	34	52

EXERCISE No. 4, WRITING THE SUM

When adding, it is often advisable to indicate the sum of the figures in each column as it is added. This plan avoids the necessity of readding columns in case the one who is adding is disturbed during the process of addition. Remember the number combinations as in previous exercises.

4827	In the illustration at the left, the sum of each column is written at the bottom, and all sums are arranged so that they can be added. This plan avoids the necessity of carrying the excess.	2038
9638		5839
4924		6382
3725		1487
5125		3154
6849	In the illustration at the right, the excess units are carried when the tens column is added, and the excess tens are carried when the hundreds column is added. The total of each column is written at the right: units first, tens second, etc. The sum is the top number and the right-hand figures in the numbers below the top number.	5537
7524		3944
3579		1458
2845		4157
2454		3648
60	In either method the one adding knows the total of the last column added if he is disturbed before he has finished.	3148 59
33		4958 68
61		6178 82
45		7893 91
51490		59821

The following problems provide practice in addition. Write the totals in *a*, *b*, and *c* as in the illustration at the left, and those in *d*, *e*, and *f* as in the illustration at the right.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
28,427	18,572	38,725	37,928	27,846	49,385
78,492	61,424	49,281	41,672	52,317	42,345
27,463	37,296	30,427	37,097	74,283	97,485
95,927	75,735	35,729	25,562	37,208	38,475
42,379	82,046	86,428	37,981	52,172	94,857
28,446	27,593	72,823	27,439	78,539	38,476
48,937	41,275	67,129	41,924	37,296	98,723
29,452	39,256	43,552	27,096	73,814	78,454
38,247	52,938	27,949	35,243	28,359	59,287
40,542	43,725	37,472	17,241	46,294	51,823

EXERCISE No. 5, COMBINATIONS

The following columns are to be added and the totals written.
Use either of the methods illustrated in Exercise No. 4.

1.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
	3,156	7,894	8,745	6,734	7,145	8,947	5,638	1,385
	4,287	3,857	1,389	1,378	3,785	2,938	3,847	5,748
	3,159	3,756	1,048	4,582	1,482	5,647	2,947	9,283
	8,937	9,283	4,873	1,375	6,628	9,283	5,647	6,743
	4,278	4,756	2,126	8,145	1,385	6,473	3,847	9,827
	1,385	2,847	4,111	6,137	1,748	6,758	3,892	7,465
	6,734	1,478	8,148	4,973	3,362	4,637	5,648	7,485
	7,836	7,831	8,375	1,375	3,785	1,384	4,635	3,847
	9,456	3,279	1,375	9,725	9,837	9,726	2,938	5,647

2.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
	8,356	9,834	9,316	5,831	5,748	5,167	2,938	4,158
	9,283	4,278	7,823	9,415	1,378	5,748	8,392	3,482
	1,478	1,582	1,287	4,837	7,745	1,483	5,647	3,128
	5,613	9,528	1,476	9,274	8,364	9,625	3,847	2,321
	9,356	4,735	5,614	1,457	5,354	7,846	4,583	5,661
	7,649	9,256	7,215	8,765	8,238	3,264	1,483	3,869
	5,167	4,175	8,475	2,736	1,574	1,475	9,137	9,384
	7,395	3,441	6,748	5,647	9,536	9,147	5,746	8,956
	4,576	3,857	6,364	9,375	1,574	5,713	3,847	1,478

3.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
	7,345	5,893	7,458	5,784	7,483	5,476	5,473	6,487
	8,246	6,587	5,673	8,473	5,674	5,352	6,432	6,837
	2,564	4,523	9,375	6,432	8,345	8,957	8,574	7,452
	4,985	7,993	8,475	8,947	7,745	2,147	9,847	3,564
	6,347	5,893	2,649	2,433	7,894	4,675	6,453	5,748
	7,763	3,574	4,356	5,372	8,564	7,436	7,574	4,376
	8,392	2,323	5,938	7,465	6,463	8,948	8,235	4,785
	4,675	8,213	6,422	9,376	4,563	4,574	6,574	3,287
	4,756	8,493	7,478	8,584	3,289	6,463	7,463	7,483
	6,354	5,783	6,934	3,857	9,521	6,483	9,487	5,475
	5,837	6,489	5,134	6,542	5,473	8,984	5,674	2,376
	5,374	8,945	5,842	8,475	8,234	5,326	4,837	6,473

EXERCISE No. 6, MONEY COLUMNS

The following problems provide practice in adding money columns. Show the totals of the columns by either method illustrated in Exercise No. 4.

The process of addition when dollars and cents are involved is the same as that used when abstract numbers are added. Cents must be kept in line with cents, and dollars with dollars, in the order of their unit value.

1.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
	\$10.79	\$18.42	\$ 1.23	\$49.15	\$13.26	\$46.50
	2.18	.75	.94	.37	1.50	.98
	1.62	1.60	6.17	2.45	9.75	1.00
	19.10	.57	9.18	21.16	4.80	9.50
	.32	9.63	10.10	3.40	28.75	15.50
	1.51	8.70	9.16	.84	1.12	7.56
	.08	.15	.13	17.20	8.75	.45
	63.07	96.24	3.21	46.35	.05	1.75
	14.26	9.63	9.46	12.54	87.50	71.25
	12.39	17.27	98.45	22.75	1.39	1.72

2.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
	\$ 7.45	\$23.10	\$ 1.98	\$17.06	\$.03	\$48.56
	32.85	.05	10.14	23.50	23.94	.32
	.92	4.50	1.75	3.15	12.39	9.63
	46.67	91.52	8.45	2.35	9.63	10.11
	1.34	13.07	1.76	2.15	18.20	3.40
	.02	.41	1.50	37.26	1.39	28.74
	14.91	8.00	25.50	18.20	61.04	1.16
	14.76	.25	7.50	39.47	.10	71.83
	3.34	.45	4.23	14.50	1.37	5.03
	.17	19.75	1.57	16.53	73.48	30.00

3.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
	\$45.23	\$14.89	\$49.90	\$25.75	\$.95	\$ 1.65
	1.93	4.50	.09	41.63	34.15	41.45
	5.05	49.90	4.50	44.42	4.23	28.42
	45.50	8.16	6.35	9.35	23.48	42.68
	16.53	.93	18.25	.02	9.57	6.75
	93.47	4.75	9.31	1.50	5.75	.75
	91.00	34.92	5.79	23.45	25.35	39.95
	3.50	9.45	15.31	94.35	95.50	3.25
	.50	93.76	23.42	1.50	4.72	13.89

CHAPTER 2

PRACTICAL PROBLEMS

1. The distance from New York to Chicago is 998 miles; from Chicago to Omaha, 488 miles; from Omaha to Cheyenne, 507 miles; from Cheyenne to Ogden, 483 miles; from Ogden to San Francisco, 783 miles. What is the distance from New York to San Francisco?

2. Below are given in the first two columns the Treasury receipts of the United States Government for two consecutive months, and in the other two columns, the receipts for two consecutive years. You are to ascertain the total of each of the four columns.

Receipts	a	b	c	d
Customs.....	\$31,035,094.56	\$25,909,177.05	\$229,157,479.87	\$215,123,708.16
Income and profit taxes..	18,914,893.85	16,716,628.22	486,687,239.35	448,030,222.79
Misc. internal revenue ..	47,630,967.35	44,344,105.06	384,581,260.63	353,462,360.18
Foreign principal.....		3,544.63	178,742.75	150,738.94
Foreign interest.....	164,169.06	171,441.10	10,424,974.58	10,883,202.62
Railroad securities.....	1,924,460.53	11,814,380.68	13,663,282.74	100,036,791.13
All others.....	1,851,918.90	2,421,420.41	13,182,253.11	3,366,352.61
Trust fund receipts....	1,211,880.89	1,651,102.71	14,371,253.09	12,508,296.28
Sale surplus property...	583,549.35	347,814.30	6,349,104.31	9,882,508.89
Panama Canal tolls....	2,059,964.42	1,667,121.64	9,053,661.71	9,752,386.78
Rec. from misc. sources..	1,496,755.92	1,080,796.22	8,882,811.44	9,900,746.20
Other miscellaneous....	8,465,616.77	8,460,300.31	60,985,079.60	65,670,236.14
TOTALS.....				

3. On March 7 Brown Brothers received an order from A. L. Day. After packing the order, the shipping clerk reported that it required twenty cases to contain the merchandise to be shipped. The weights in pounds of these cases were as follows: 256, 319, 408, 271, 400, 356, 445, 485, 316, 389, 412, 487, 365, 358, 427, 475, 247, 268, 349, and 285. The cases were numbered in the order given, beginning with 1, and the number and the weight were written on the outside of each case.

You are to prepare a list showing the number and the weight of each case, and the total weight of all the cases.

4. A. F. Allen earned \$356.50 during August. During September he earned \$39.75 more than in August, and in October he earned as much as he did during August and November. If he earned \$150 in November, how much did he earn in: (a) September, (b) October, and (c) the four months?

5. J. H. Grusen accepted the following bids on the construction of a home: foundation, \$2,181.45; lumber, \$4,216.50; bricks, \$955.15; construction of house including roof, \$3,917; plastering, \$1,845.50; painting, \$965.05; plumbing, \$1,842.50; electric wiring, \$722.95. You are to ascertain the total cost of the house, based on these bids.

6. It is the usual practice for clerks to make a sales ticket for each sale made. The information contained in the ticket is given in the illustration at the right. When a charge sale is made, the ticket is usually made in duplicate. One copy is given to the customer or wrapped with the package; the other copy is sent to the office so that the bookkeeper can make the proper record of the transaction.

HARDWARE TOOLS SPORTING GOODS		SCHIFF'S		CUTLERY FANCY GOODS GAS LIGHTING SUPPLIES	
121-123 W. FIFTH ST.				PHONE MAIN 474	
Cincinnati, O., <u>7/27</u> 19 <u> </u>					
M. <u>Agnes L. Schneider</u>					
Address <u>460 E. King St. City</u>					
1	lb. Nails				08
1	Brush				75
1	Mirror				2 60
Number	Cash Received	Clerk	Total Sale		
820	5 00	G.B.	3	43	

Sales Ticket

Assume that you are a clerk and have sold A. C. Colvin, 195 First Street, City, the following for cash: 10 lbs. of sugar, 85c; 1 roast chicken, \$1.05; 2 lbs. of butter, 72c. Either complete this problem on blank paper or get a sales ticket from your local store and fill in the information.

7. Sold J. W. Brown of 250 Market Street, City, the following on account: 2 lbs. of bacon, 68c; 1 sack of flour, \$1.15; 3 lbs. of nuts, 75c; 1 ham, \$5.85; 5 lbs. of lard, 95c. Make a sales ticket as suggested in the previous problem.

CHAPTER 3

PROOF OF ADDITION

Business is not satisfied with results that are only approximately correct. Its operations depend upon figures which are known to be correct. Those completing business calculations in which there is a chance of error must therefore prove the correctness of their work. In this chapter we shall study the method of proving the correctness of solutions to problems in addition.

EXERCISE No. 7, PROOF BY REVERSE ADDITION

Obviously the same total should be found when a column of figures is added from the bottom to the top as when it is added from the top to the bottom. The correctness of the total of a column may then be proved by adding the column in the direction opposite to that first used. If the column is added in the same direction as that first used, there is danger that the same error may be repeated. This danger is greatly lessened, if not entirely removed, by addition in the opposite direction for the reverse addition almost invariably results in new combinations of figures.

	When the figures are added from the top to the
17642√26	bottom, the sum of the units column (23) is written
97868√26	at the right of the bottom amount; the sum of the
44591√33	tens column (29), including the 2 carried from the
92865√29	units column, is written above the sum of the units
13427√23	column. In the same manner the hundreds, thou-
√266393	sands, and tens of thousands are added, the amount
	carried being included in each addition. The sum of
	all the numbers is 266,393, which is equivalent to the
	top number and the unit digits in the other totals.

The check mark (√) indicates that the columns have been re-added and the sum of each is correct. If, when a column is re-added, the sum is not the same by the second addition as by the first, it is necessary to continue to re-add until the two sums are the same.

The following problems provide practice in adding and proving the results as illustrated and explained above. You are to show: (a) the total of each column with the excess carried, and (b) the proof of the addition.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
65,291	95,243	42,961	37,925	75,689	92,543
34,296	17,845	30,542	59,821	49,100	17,762
59,783	85,391	59,672	20,076	81,047	69,043
45,574	27,956	68,734	47,372	52,165	22,598
67,523	70,123	75,643	19,372	48,623	34,256
33,756	36,824	90,179	65,033	21,809	76,895
95,273	68,462	22,981	96,751	40,675	26,174
<u>76,754</u>	<u>45,980</u>	<u>37,549</u>	<u>71,023</u>	<u>39,172</u>	<u>55,167</u>

EXERCISE No. 8, PROOF BY REVERSE ADDITION

In the preceding exercise the sum of each column was written at the right and the amount was carried by mental process. The amount to be carried may be written at the top of the column and included in the addition of the column. This process is illustrated below.

✓✓✓✓	The figures in the units column are added from bottom to top, the 3 is written under the line, and the 2 is written at the top of the tens column. The figures in the tens column are added, the 2 which was carried and written at the top being included in the total of the column (29); the 9 is written as the tens in the sum, and the 2 carried is written above the hundreds column. The same plan is followed in adding the other columns. The check mark above each column indicates re-addition and proof.
2322	
17642	
97868	
44591	
92865	
13427	
<u>266393</u>	

The following problems provide practice in adding and indicating the amount to be carried as illustrated above. Write the sums and the amounts carried, and use check marks to show proof.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
28,735	76,543	22,154	76,253	31,754	31,416
39,601	20,174	39,701	90,125	27,590	29,847
77,825	37,592	51,579	85,704	20,016	37,645
43,526	52,164	26,438	44,123	49,385	55,102
90,285	31,756	99,753	78,991	75,309	60,813
21,746	27,539	78,522	21,375	21,804	82,148
37,059	98,076	54,876	45,804	37,512	78,695
<u>98,462</u>	<u>54,163</u>	<u>77,145</u>	<u>39,567</u>	<u>28,543</u>	<u>41,906</u>

EXERCISE No. 9, PROOF BY REVERSE ADDITION

The sums of the columns may be written so that they can be added to obtain the result. When this plan is followed, the excess tens, hundreds, etc., are not carried, and a check mark is written at the left of the sum of each column to indicate proof of addition.

$$\begin{array}{r} 7642 \\ 7868 \\ 4591 \\ 2865 \\ \hline \sqrt{16} \\ \sqrt{25} \\ \sqrt{27} \\ \sqrt{20} \\ \hline \sqrt{22966} \end{array}$$

The sum of the figures in the units column is written at the right; the sum of the figures in the tens column, without the figure carried, is written below and to the left of, the sum of the units column. The same plan is followed in adding the figures in the other columns. The sum of the four numbers is the sum of the units, tens, hundreds, and thousands columns. The check marks at the left show re-addition and proof.

The following problems provide practice in adding and indicating the totals of columns as illustrated above. You are to show: (a) the sum of each column arranged as in the illustration, (b) the total of these sums, and (c) the check marks at the left to indicate re-addition and proof.

1.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
	45,239	59,837	31,697	92,873	34,691	22,145
	37,865	21,784	43,501	47,321	12,978	39,864
	90,746	40,976	70,463	19,843	50,013	52,017
	76,904	35,791	99,443	40,125	49,678	49,176
	32,175	24,680	27,756	72,591	85,049	67,589
	95,483	97,531	34,527	87,645	76,142	61,678

2.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
	66,349	20,981	88,645	31,802	64,178	22,198
	40,581	34,896	40,826	75,184	45,019	34,567
	75,491	15,135	41,389	44,510	65,233	32,415
	27,116	19,763	65,482	31,709	31,746	98,765
	34,763	43,579	91,534	16,718	41,578	12,345
	56,708	74,350	64,351	34,902	29,713	19,005

EXERCISE No. 10, VERTICAL AND HORIZONTAL ADDITION

Vertical and horizontal addition refers to the adding of two or more separate columns vertically and horizontally to prove the correctness of all additions. The following problem and its solution illustrate the application of this method.

$$\begin{array}{r}
 2+7+3+5+6+9=32 \\
 4+3+7+8+6+3=31 \\
 2+7+9+4+8+5=35 \\
 5+4+3+6+8+2=28 \\
 \hline
 13+21+22+23+28+19=126
 \end{array}$$

Each column is added vertically and horizontally. The sum secured by the vertical addition is written under each column; that secured by the horizontal addition, at the right. The process of addition should be from bottom to top for the vertical and

from left to right for the horizontal. The proof is effected by adding the totals at the bottom horizontally, and the totals at the right vertically.

The following problems provide practice in proving totals through vertical and horizontal addition. You will show the totals obtained by adding vertically and horizontally and the proof effected through the addition of these totals.

$$\begin{array}{r}
 1 \\
 2+9+4+7+8+3+9=? \\
 8+4+3+8+5+7+3=? \\
 4+2+7+4+6+4+5=? \\
 1+3+7+4+7+3+7=? \\
 9+4+6+3+6+9+6=? \\
 7+2+3+5+8+2+3=? \\
 7+8+4+9+6+3+8=? \\
 6+5+3+8+9+5+6=? \\
 \hline
 ?+?+?+?+?+?+?=?
 \end{array}$$

$$\begin{array}{r}
 3 \\
 5+6+5+7+4+3+5=? \\
 6+4+7+8+2+9+6=? \\
 3+6+4+5+7+5+3=? \\
 5+3+7+4+6+7+4=? \\
 8+4+5+6+7+3+6=? \\
 9+6+7+8+8+2+8=? \\
 4+5+6+7+3+2+2=? \\
 6+5+4+3+7+8+5=? \\
 \hline
 ?+?+?+?+?+?+?=?
 \end{array}$$

$$\begin{array}{r}
 2 \\
 7+4+7+4+8+2+4=? \\
 1+4+6+3+7+2+6=? \\
 2+4+5+3+3+4+9=? \\
 4+7+2+7+4+6+3=? \\
 9+6+7+4+3+7+2=? \\
 1+4+3+6+7+3+5=? \\
 4+7+5+6+8+7+9=? \\
 5+7+4+6+8+2+3=? \\
 \hline
 ?+?+?+?+?+?+?=?
 \end{array}$$

$$\begin{array}{r}
 4 \\
 4+6+5+7+8+9+7=? \\
 5+9+8+7+4+2+9=? \\
 1+4+2+3+6+8+3=? \\
 4+7+5+6+7+9+5=? \\
 3+6+4+4+3+6+8=? \\
 5+3+7+4+5+6+4=? \\
 2+1+3+3+5+4+2=? \\
 3+6+9+3+4+7+6=? \\
 \hline
 ?+?+?+?+?+?+?=?
 \end{array}$$

CHAPTER 4

PRACTICAL PROBLEMS

1. Factory employees are usually paid weekly. The amount due each employee is obtained from a record of his time maintained in the accounting department. It is necessary for the paymaster to know on pay day: (a) the amount due each employee, (b) the total amount necessary to pay all employees, and (c) the money necessary to make up the pay roll so that the amount due each employee can be inclosed in an envelope.

The Brown Manufacturing Company employs twelve employees in one department of its factory. The following pay-roll sheet shows the daily earnings of each employee.

Name	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total
Brown	6.37	7.45	6.25	6.75	6.00	6.47	
Clark	5.95	5.45	6.25	5.89	5.79	5.73	
Davis	6.75	6.95	6.55	6.34	6.47	6.50	
Ellis	7.00	7.25	7.45	6.95	7.43	7.59	
Ely	5.78	5.85	5.48	5.15	5.98	6.50	
French	7.35	7.25	6.89	6.95	6.12	5.59	
Garrett	6.89	7.84	7.57	7.24	7.18	7.31	
Howard	5.45	5.68	5.79	5.85	5.95	5.79	
Innes	7.35	7.47	7.61	7.83	7.98	7.55	
Jones	6.47	6.63	7.05	6.95	6.47	6.59	
King	5.89	5.74	6.47	6.53	6.63	6.51	
Miller	6.21	6.36	6.63	6.55	6.37	6.49	
TOTAL							

You are required to ascertain: (a), by horizontal addition, the amount due each employee; (b), by vertical addition, the total amount of the daily pay roll; (c) the proof of this amount, and (d) the money necessary to pay each employee.

The method of ascertaining the correct amount of currency and change due each employee is illustrated below.

Amount	20's	10's	5's	2's	1's	50c	25c	10c	5c	1c
39.29	1	1	1	2			1			4
35.06	1	1	1						1	1
39.56	1	1	1	2		1			1	1

The illustration shows the amount due the first three employees. You will observe that columns are provided for the amount due each employee and the various denominations of currency and change. On a line with the amount due each employee is indicated the number of pieces of each denomination necessary to pay the employee. The least possible number of pieces is used.

2. On March 7 Brown Brothers, manufacturers of men's clothing, received an order from A. L. Day, one of their customers. This order was referred to the shipping clerk with instructions to pack the merchandise in cases and to give the office a statement of the weight of each case. After packing the merchandise ordered, the shipping clerk reported that it required twelve cases to contain the merchandise. These cases were numbered in regular order, beginning with 1, and the weights reported were: 256 lbs., 319 lbs., 408 lbs., 271 lbs., 400 lbs., 353 lbs., 455 lbs., 485 lbs., 316 lbs., 389 lbs., 412 lbs., 487 lbs. Assuming that the cases were numbered in the order in which the weights are given, show the number and the weight of each case and the total weight. Prove by reverse addition.

3. The Jones Mercantile Company received a consignment of merchandise contained in ten cases. The total weight of these cases as shown on the bill of lading was 1,886 pounds. The weight in pounds of the cases was shown on the invoice as follows: 199, 156, 142, 237, 219, 86, 155, 181, 148, and 263. You are to list the weights, to add them, and to show that your total is correct.

4. Robert Decker delivered ten truck loads of wheat to an elevator. The net weight in pounds of the wheat in each truck

was as follows: 4,165, 4,221, 3,962, 4,144, 4,355, 3,998, 4,455, 4,687, 4,563, and 4,471. List these weights and ascertain the total weight of the wheat delivered.

5. James Dodson delivered to the Brown Commission Company twenty-five bags of potatoes, the weights of which, in pounds, were as follows: 125, 119, 121, 115, 124, 117, 122, 116, 123, 118, 121, 115, 118, 125, 119, 124, 122, 117, 116, 123, 115, 119, 125, 117, and 122. List these weights, add them, and prove your total.

6. J. W. Dillman delivered to a cannery twelve truck loads of green corn, the weights of which, in pounds, were as follows: 3,756, 3,942, 4,291, 4,372, 4,150, 3,890, 3,650, 4,097, 4,400, 3,854, 3,905, and 4,321. List these weights, add them, and prove the sum by reverse addition.

7. The Davis Manufacturing Company employs five traveling salesmen, each of whom reports his weekly expenses at the end of the week. The following are the expenses of each of these salesmen during thirteen weeks beginning January 2:

<i>Date</i>	<i>Ray</i>	<i>Day</i>	<i>Foy</i>	<i>Lock</i>	<i>Cole</i>
January 7.....	\$67.89	\$75.80	\$62.50	\$84.79	\$76.77
January 14.....	7.25	67.89	75.50	78.54	68.90
January 21.....	75.98	81.45	80.45	72.43	83.45
January 28.....	67.50	73.56	83.29	67.89	70.21
February 4.....	83.45	84.56	77.22	75.49	75.76
February 11.....	74.50	6.54	68.75	62.45	79.80
February 18.....	65.43	83.67	72.75	74.56	82.34
February 25.....	78.95	79.80	70.89	77.86	7.50
March 4.....	73.45	80.75	81.76	83.45	80.98
March 11.....	62.34	77.87	65.78	65.89	65.90
March 18.....	69.70	61.89	74.96	9.25	77.75
March 25.....	84.39	65.40	69.70	67.80	68.40
April 1.....	81.70	82.43	7.65	84.35	82.90

Show: (a) the horizontal addition, (b) the vertical addition, and (c) the final total and proof.

8. The sales manager for the Craig Grocery Company wishes to know the total sales made by each of the six traveling salesmen during the first six months of the year and also the total sales of all the six salesmen for the same term. These sales are recorded

in the books of the company as follows: J. O. Richards, \$551.65, \$423.38, \$647.27, \$675.42, \$582.26, \$743.25; Louis Garrison, \$789.45, \$675.25, \$725.31, \$752.47, \$712.46, \$863.22; R. T. Welch, \$864.33, \$784.22, \$792.23, \$825.89, \$789.95, \$835.42; C. T. Gray, \$646.25, \$595.29, \$651.94, \$642.24, \$603.33, \$755.11; John Hume, \$932.49, \$764.48, \$827.72, \$832.46, \$789.72, \$843.68; T. B. Wood, \$865.22, \$798.63, \$825.26, \$851.82, \$846.88, \$875.50. Arrange these figures so that you can show the facts desired. Prove by vertical and horizontal addition.

9. The Union Manufacturing Company has fifteen employees. The pay roll for the week ending January 9 is as follows:

Name	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total
White	10.22	9.78	11.17	9.66	9.83	9.17	
Donley	9.57	10.19	8.73	9.78	8.89	9.45	
Hayes	9.63	11.28	10.32	10.26	9.17	9.65	
Duggan	10.87	9.74	10.09	9.91	9.87	9.34	
Smith	8.98	12.98	10.16	10.52	8.76	9.32	
Ernst	9.15	10.51	10.37	10.23	9.75	9.27	
Evers	9.39	10.41	9.87	9.27	9.21	9.39	
Burns	7.99	11.85	9.34	9.73	10.79	9.71	
Kraus	10.78	8.23	9.17	9.88	9.43	9.99	
Fisher	12.13	7.41	9.39	9.76	8.17	9.79	
Grant	11.54	9.19	10.67	10.87	9.67	9.32	
Ebert	9.67	10.43	10.02	9.78	9.43	9.89	
Jones	11.91	8.34	10.18	10.15	10.76	9.78	
Miller	10.52	9.87	10.37	9.75	11.21	9.45	
Wade	11.83	8.15	9.45	8.17	10.67	9.86	
TOTAL							

You are to find: (a) the amount due each employee, (b) the total daily wages, (c) the total due the fifteen employees at the end of the week, and (d) the number of pieces of each denomination of money required to pay each employee.

10. The Central Garage employs six men in its repair department. Each man keeps a record of his time on a card, this record being checked with the charge sheets for repair work. The amounts due each employee for the week ending Saturday, May 14, are shown on the card records as follows:

James Moore, Monday \$7.60, Tuesday \$8.80, Wednesday \$9.75, Thursday \$9.87, Friday \$8.97, Saturday \$9.45; John Brown, Monday \$7.75, Tuesday \$8.85, Wednesday \$9.85, Thursday \$9.95, Friday \$8.75, Saturday \$7.75; Ray Whitney, Monday \$8.85, Tuesday \$9.45, Wednesday \$9.65, Thursday \$8.95, Friday \$7.75, Saturday \$8.80; Don Clark, Monday \$8.85, Tuesday \$9.25, Wednesday \$9.75, Thursday \$8.75, Friday \$9.50, Saturday \$8.95; Harry Miller, Monday \$9.75, Tuesday \$8.85, Wednesday \$7.95, Thursday \$9.87, Friday \$8.68, Saturday \$9.56; Frank Smith, Monday \$8.87, Tuesday \$8.95, Wednesday \$9.53, Thursday \$9.78, Friday \$8.98, Saturday \$9.75.

You are required (a) to rule a form similar to that in Problem 1 and to arrange the names of the employees and the amounts due each in the same manner, (b) to ascertain the amount due each employee on pay day, (c) to find the total amount necessary to make up the pay roll, and (d) to determine the number of pieces of each denomination required by the paymaster to pay each employee.

11. The total valuation of public utilities in Ohio during two consecutive years is shown in the following table:

	First Year	Second Year
Steam railroad companies.....	\$839,465,430	\$826,683,420
Street car companies,		
suburban and interurban.....	179,506,770	183,440,700
Natural gas companies.....	113,572,550	118,552,250
Artificial gas companies.....	1,481,100	845,630
Telephone companies.....	127,047,580	119,512,590
Electric light companies.....	208,592,280	178,035,090
Waterworks companies.....	6,164,370	6,076,570
Pipe line companies.....	26,250,480	28,306,650
Messenger and signal companies.....	1,088,750	1,069,270
Heating and cooling system companies.	321,920	303,570
Express companies.....	1,943,370	1,931,530
Telegraph companies.....	9,933,950	9,325,600
Water transportation companies.....	396,490	2,472,930
Union depot companies.....	4,552,190	3,950,560

You are to ascertain: (a) the total valuation for the first year, and (b) the total valuation for the second year.

12. According to the fundamental principles of bookkeeping, the total resources should equal the sum of the total capital and the liabilities. Add the amounts and prove the following bank statement.

BROTHERHOOD NATIONAL BANK

REPORT OF CONDITION AT THE CLOSE, ON DECEMBER 31, 19...

RESOURCES

Loans and discounts.....	\$1,400,241.60
Overdrafts: secured \$200.06, unsecured \$459.32.....	659.38
U. S. Government securities owned:	
Deposited to secure circulation.....	200,000.00
All other government securities.....	13,043.00
Other bonds, stocks, securities, &c.....	1,658,890.15
Furniture and fixtures.....	49,019.59
Lawful reserve with Federal Reserve Bank.....	127,313.24
Cash in vault and due from national banks.....	168,569.65
Amount due from banks.....	4,457.26
Exchanges for clearing houses.....	46,562.94
Miscellaneous cash items.....	3,081.00
Redemption fund deposited with U. S. Treasurer.....	10,000.00
Other assets.....	38,593.12

Total Resources.....

CAPITAL AND LIABILITIES

Capital stock paid in.....	\$ 200,000.00
Surplus fund.....	50,000.00
Reserved for taxes, interest, &c., accrued.....	5,765.43
Circulating notes outstanding.....	200,000.00
Amount due to national banks.....	37,826.28
Certified checks outstanding.....	9,569.27
Cashier's checks outstanding.....	16,066.41
Demand deposits.....	577,600.34
Certificates of deposit due in less than 30 days.....	9,596.66
Other certificates of deposit.....	37,036.00
State, county, or other municipal deposits.....	300,000.00
Other time deposits.....	2,272,689.82
Liabilities other than those above stated.....	4,280.72

Total Capital and Liabilities.....

UNIT 2

SUBTRACTION

CHAPTER 5

PRINCIPLES AND DRILLS

The purpose of the following chapters is to provide practice in subtraction and in the proof of the correctness of solutions. The explanation and the problems are given under the assumption that you understand the mathematical principles involved in the process of subtraction.

Subtraction is the process of finding the difference between two numbers. The number to be diminished is the *minuend*. The number subtracted is the *subtrahend*. The result obtained in subtraction is known as the *difference*, the *balance*, or the *remainder*.

EXERCISE No. 12, RETROGRESSIVE SUBTRACTION

Retrogressive subtraction provides excellent practice in obtaining the difference between two numbers. In the following drill, subtract in each case until the remainder is less than the number subtracted.

1. Begin with 47 and subtract by 2's; 4's; 6's; 8's.
2. Begin with 92 and subtract by 3's; 5's; 7's; 9's.
3. Begin with 98 and subtract by 5's; 7's; 9's; 3's.
4. Begin with 78 and subtract by 4's; 6's; 8's; 2's.
5. Begin with 88 and subtract by 3's; 5's; 7's; 9's.
6. Begin with 64 and subtract by 6's; 8's; 4's; 2's.
7. Begin with 73 and subtract by 5's; 7's; 3's; 9's.
8. Begin with 96 and subtract by 8's; 4's; 6's; 2's.

EXERCISE No. 13, SUBTRACTION

The purpose of the following problems is to provide oral practice in determining the difference between two numbers of one or more figures. With practice you can learn to subtract as rapidly as you can read combinations in addition.

NOTE: Subtraction is a process of addition. Thus, in the first problem, you are required to subtract 3 from 6; this process is equivalent to adding 3 and 3. You should prove all subtraction by adding the difference to the subtrahend.

1.	6	5	8	7	5	9	4	3	8	6	5	9
	3	2	4	5	2	3	3	2	5	2	4	7
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
2.	17	14	17	16	18	15	19	12	16	13	19	15
	6	3	4	5	4	3	7	2	5	2	8	4
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
3.	19	16	18	14	12	16	18	14	17	14	18	13
	13	10	14	12	10	14	17	13	12	12	16	11
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
4.	25	28	35	27	36	39	27	24	37	28	24	35
	22	26	34	22	33	25	23	21	31	25	21	32
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

EXERCISE No. 14, SUBTRACTION BY ADDITION

The Austrian method of subtraction is to add to the smaller number a number which will make the smaller equal to the larger, the number added being the difference. The following problems provide oral practice in applying this method.

1.	9	7	4	8	5	8	7	6	9	9
	7	3	2	6	2	5	4	3	4	2
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
2.	18	14	15	19	13	19	17	18	14	18
	13	12	13	16	11	13	14	10	11	14
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
3.	38	39	47	58	32	68	48	69	38	57
	29	23	29	57	27	39	35	24	32	39
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
4.	42	54	65	45	63	47	32	67	41	56
	26	25	38	27	39	28	16	29	35	27
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

EXERCISE No. 15, SUBTRACTION BY ADDITION

The following problems provide practice in applying the Austrian method of subtraction. Arrange your work as in the illustration.

*Subtraction**Explanation*

1235
 —786
 ———
 449

6 and 9 are 15
 9 and 4 are 13
 8 and 4 are 12

Unless you are accustomed to subtracting by the Austrian method, it will seem more difficult than the process of subtracting the subtrahend from the minuend. However, through practice in using this method, you

will become more proficient, and, it is claimed, more accurate.

1.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
	4,375	21,847	\$38,576.25	\$45,287.37	\$28,374.45
	<u>283</u>	<u>3,146</u>	<u>2,873.48</u>	<u>2,837.79</u>	<u>4,726.28</u>

2.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
	5,847	41,387	\$83,746.88	\$82,736.56	\$73,846.26
	<u>378</u>	<u>3,847</u>	<u>3,746.57</u>	<u>2,837.28</u>	<u>3,746.58</u>

3.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
	8,572	41,587	\$57,362.84	\$38,473.32	\$39,283.45
	<u>398</u>	<u>6,453</u>	<u>4,857.68</u>	<u>9,485.86</u>	<u>3,847.38</u>

EXERCISE No. 16, SUBTRACTION AND PROOF

The purpose of this exercise is to provide practice in subtraction. Each problem should be proved by addition as explained on page 25. Place a sheet of paper under each problem, subtract, write the difference on this sheet, and prove by adding the difference to the subtrahend. Place a check mark at the left of each difference to indicate the proof.

1.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
	478	\$7,847	59,847	\$587.46	584,736	\$4,564.35	483,766
	<u>127</u>	<u>5,849</u>	<u>48,372</u>	<u>376.28</u>	<u>483,769</u>	<u>2,736.58</u>	<u>138,476</u>

2.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
	983	\$5,838	84,736	\$837.47	685,746	\$8,475.67	685,746
	<u>595</u>	<u>2,876</u>	<u>27,365</u>	<u>574.38</u>	<u>328,746</u>	<u>3,837.37</u>	<u>451,678</u>

3.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
	938	\$7,839	58,473	\$587.48	857,463	\$2,837.57	685,743
	<u>473</u>	<u>3,765</u>	<u>47,362</u>	<u>384.37</u>	<u>584,736</u>	<u>1,476.38</u>	<u>415,876</u>

4.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
	634	\$8,473	84,937	\$587.39	584,736	\$5,847.84	796,854
	<u>489</u>	<u>6,857</u>	<u>57,438</u>	<u>513.28</u>	<u>293,874</u>	<u>1,345.68</u>	<u>148,376</u>

5.	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
	529	\$9,721	56,723	\$365.27	697,642	\$4,923.15	620,713
	<u>385</u>	<u>3,498</u>	<u>34,962</u>	<u>198.75</u>	<u>576,333</u>	<u>2,168.75</u>	<u>396,752</u>

CHAPTER 6

PRACTICAL PROBLEMS

Railroad time-tables. It is customary for a railroad to provide a time-table, showing detailed information regarding all trains operated on each division of its roads. The time-table given below shows the schedule of trains on the Cincinnati Division of the Big Four Railroad.

Table
No. 13 CINCINNATI TO INDIANAPOLIS AND CHICAGO

Miles	STATIONS	15	19	43	31	35	5	31	33	27
	Central Standard Time	Chi- ago Lim. Daily	White City Sp'c'l Daily	Chi- ago Exp. Sun.	Royal Palm Daily	Chi- ago Night Sp'c'l Daily	The Sycam- ore Daily	Chgo. Mail and Exp. Daily	Ind- pls. Lim. Daily	Exp. Daily
0	CINCINNATI. Lv	9 00	12 00	8 30	9 45	11 55	PM	AM	6 00	3 00
17	Valley Jct.							7 30		
22	Lawrenceburg Jo			G 9 04	10 17			8 15		
27	Guilford.							8 30		3 35
31	Bonnell.							8 40		f 3 44
36	Weisburg.							8 46		f 3 50
39	Sunman.							8 59		f 4 00
41	Spades.							9 08		f 4 10
45	Morris.							9 12		4 13
47	Batesville.	10 11		9 42	10 52			9 20		4 20
54	New Point.							9 26		4 25
58	McCoy.							9 37		4 35
62	Greensburg.	10 35	1 26	10 05	11 12	1 14		9 45	J 4 42	
67	Adams.							10 00	7 25	4 55
72	St. Paul.							10 11		f 5 05
75	Waldron.							10 19		f 5 12
82	Shelbyville.	11 04	1 51	10 33	11 41	Q.		10 24		f 5 16
89	Fairland.		E 2 01					10 43	7 49	5 29
96	Aecon.							10 54		5 40
103	Beech Grove.							11 05		f 5 50
109	IND'NAPOLIS. Ar	11 50	2 35	11 20	12 25	2 35		11 20		
109	IND'NAPOLIS. Lv	12 00	2 45	11 35	12 40	2 35	5 00	11 45	8 30	6 20
120	Augusta.							12 15		
125	Zionsville.							12 35		
130	Whitestown.							12 42		
138	Lebanon.		3 28	12 22	H 1 31		5 42	12 51		
143	Hazelrigg.							1 05		
147	Thorntown.		3 40	12 38	H 1 50			f 1 12		
153	Colfax.							1 20		
158	Clark's Hill.							1 30		
161	Stockwell.							1 40		
165	Crane.							1 44		
174	LAFAYETTE.	1 30	4 18	1 45	2 55	4 16	6 25	f 1 58		
192	Templeton.							2 20		
196	Atkinson.							2 52		
198	Swanington.			f 2 30				f 2 53		
207	Fowler.		5 02	2 40	H 3 46			3 15		
209	Earl Park.		5 13	2 54	H 3 58			3 31		
211	Sheff.							f 3 37		
214	Raub.			f 3 01	H 4 08			3 43		
219	Sheldon.		5 28	3 14	H 4 18			3 58		
223	Tronquois.			G 3 23	H 4 27			4 10		
237	Danovo.			f 3 31	H 4 36			4 24		
242	Beaverville.			f 3 41	H 4 46			4 36		
238	St. Anne.			f 3 51	H 4 56			4 51		
244	Aroma Park.			G 4 00	H 5 06			5 02		
248	Kankakee. Ar	3 20	6 16	4 20	5 15	6 10	8 05	5 20		
284	Harvey.				H 6 18			H 6 17		
290	Kensington.				H 6 32			H 6 25		
295	Grand Crossing									
296	63d Street.	4 36	7 41	5 47	6 45	7 30	21	6 35		
298	Hyde Park 53d St.	4 40	7 44	5 51	6 48	7 33	24	6 42		
299	43d Street.	4 43	7 47	5 55	6 51	7 36	27	6 46		
303	CHICAGO. Ar	4 55	7 59	6 10	7 05	7 50	40	7 00		
	(Central Sta. — Mich. Ave. & Roosevelt Rd.)	PM	PM	AM	AM	AM	PM	PM		

The description of each train by number and name is given at the top of the column which shows its running time. Each train leaves Cincinnati at the time mentioned on a line with Cincinnati and arrives at each of the other stations at the time given on a line with the name of the station. No time indicates that the train does not stop. The figures at the left of the name of a town indicate the miles between the town and Cincinnati.

Problems 1 to 7 in subtraction are based on the information given on the preceding page. These problems should be solved orally, unless your instructor requires that you write them.

1. Ascertain the distance between Morris and Kankakee.
2. Ascertain the distance between Spades and Chicago.
3. How long does it take Train No. 15 to go from Batesville to Lafayette?

NOTE: Time printed on the time-table in light face type is between twelve midnight and twelve noon, and that printed in bold face type, between twelve noon and twelve midnight.

4. How long does it take Train No. 1 to go from Cincinnati to Sheldon?
5. Ascertain the distance between McCoy and St. Anne.
6. Ascertain the distance between Chicago and Adams.
7. How long does it take Train No. 27 to go from Guilford to Indianapolis?
8. The distance between Boston and New York on the New York, New Haven and Hartford Railroad is 232 miles. The distance between Boston and Springfield, Massachusetts, which is between Boston and New York, is 98 miles. How far is it from Springfield to New York?
9. The distance between Chicago and Pittsburgh on the Pennsylvania Railroad is 468 miles, and the distance from Fort Wayne to Chicago on the same road is 148 miles. How far is it from Fort Wayne to Pittsburgh?
10. The Overland Limited leaves Chicago at 8:10 P.M. on Sunday and arrives in San Francisco at 2:30 P.M. on Wednesday. What is the exact time of this train in transit? The time is moved back one hour at North Platte and one hour at Ogden.
11. If a train leaves Portland, Oregon, at 8:10 P.M. and arrives at Seattle, Washington, at 1:30 P.M. on the following day, what time is required for it to travel between these two cities? No change in time is involved.

12. If Train No. 101 on the Southern Pacific leaves New Orleans at 12:10 P.M. on Friday and arrives in El Paso at 9:20 P.M. on Saturday, what time is required to cover the distance? No change in time is involved.

13. The following advertisement, setting forth bargain prices, appeared in a daily newspaper. In accordance with the prices in the advertisement, you are to state the saving to the purchaser on each article.

50c Jonteel Cold Cream, 39c	50c Pepsodent Tooth Paste, 36c
25c Cuticura Soap, 18c	50c Ipana Tooth Paste, 37c
25c Resinol Soap, 19c	35c Ponds Vanishing Cream, 23c
25c Woodbury Soap, 17c	75c Stacomb, 59c
\$1.25 Lilac Vegetal, 86c	50c Jonteel Van. Cream, 39c
75c Java Rice Powder, 39c	\$1.00 Listerine, 73c
50c Hinds Cream, 35c	\$1.00 Rem for coughs, 69c
50c Mennen's Cream, 34c	75c Olive Oil, 49c

14. Omaha is 1,033 feet above sea level; Chicago is 590 feet above sea level; and Denver is 4,149 feet higher than Omaha. How much higher is Denver than Chicago?

15. The highest point in the United States is Mount Whitney, California; the lowest is Death Valley, California. Mount Whitney has an elevation of 14,496 feet above sea level; Death Valley, 276 feet below sea level. How much higher is Mount Whitney than Death Valley?

16. The following is the income of the United States Government for two consecutive years. You are to ascertain the total receipts for each year and the increase or decrease for the second year.

	First Year	Second Year
Distilled spirits.....	\$ 25,902,820.28	\$ 27,580,380.64
Fermented liquors.....	1,954.44	5,373.50
Tobacco manufactures...	345,247,210.96	325,638,931.14
Oleomargarine.....	3,038,927.84	2,914,104.14
Capital stock tax.....	95,814,152.60	95,286,105.44
Miscellaneous.....	344,738,257.14	490,676,910.89
Internal revenue stamps.	7,738,895.47	12,418,180.25
Income and profit taxes..	1,761,695,099.51	1,841,759,316.80

17. A. L. Davis paid \$22,500 for a farm and sold it for \$25,675. What was his profit after he paid \$770.25 as a commission to the agent who made the sale?

18. The Cambria Manufacturing Company had on January 2 raw material, to be used in manufacturing, valued at \$14,467.75. During the year additional raw material was purchased for \$42,561.99. The cost of labor used in manufacturing goods from this raw material was \$14,461.90; and the other manufacturing expenses were \$14,378.55. At the end of the year raw material on hand was worth \$18,261.54. Ascertain the cost of the goods manufactured during the year.

19-20. The prices in the two problems given below are quoted from an after-Christmas bargain sale. You are to ascertain in each problem: (a) the saving on each article, and (b) the total saving if one customer bought one each of the articles given in the problem.

19.

\$3.75 Sheets at \$2.90
 \$4.75 Sheets at \$3.89
 \$5.00 Sheets at \$3.98
 \$5.50 Sheets at \$4.29
 \$1.25 Sheets at \$1.05
 \$1.65 Sheets at \$1.29
 \$1.79 Sheets at \$1.39
 \$5.00 Napkins at \$3.98
 \$1.25 Damask at 89c
 \$4.50 Napkins at \$3.59
 \$6.50 Napkins at \$4.98
 \$7.50 Napkins at \$5.98
 \$10.00 Napkins at \$6.98
 \$7.00 Bed Sets at \$4.98
 \$4.50 Bed Sets at \$3.25

20.

25c Irish crash, yd. 19c
 50c Irish crash, yd. 39c
 29c Linen crash, yd. 22c
 \$2.50 Damask, yd. \$1.69
 \$1.50 Table padding, yd. 98c
 35c Turkish towels 25c
 42c Turkish towels 33c
 50c Turkish towels 39c
 69c Turkish towels 49c
 \$6.00 Napkins at \$4.59
 \$4.25 Sheets at \$3.39
 \$1.85 Sheets at \$1.59
 \$10.00 Bed Sets at \$7.59
 \$5.25 Table Cloths at \$4.45
 \$7.35 Table Cloths at \$6.58

21. During a certain business year the sales of the Fox Mercantile Company were \$24,721.40. The merchandise in stock at the beginning of the year was valued at \$6,241.82; the purchases during the year were \$15,265.92; and the merchandise in stock at the end of the year was valued at \$4,427.35. How much profit did the Fox Mercantile Company make on the sales?

22. The information given in the following table is from a report published by the Federal Reserve Bank in New York City at the close of a certain year. You are to ascertain: (a) the total new capital, (b) the total refunding, and (c) the difference between the two.

	New Capital	Refunding
Railroads.....	\$ 369,745,730	\$124,853,000
Public utilities.....	1,449,510,304	226,266,300
Industrials—		
Iron, steel, coal, copper.....	194,992,500	21,496,000
Equipment manufacturers.....	13,840,000	
Motors and accessories.....	191,136,721	22,241,389
Other industrials and manufacturing.....	453,435,108	79,281,400
Oil.....	147,857,528	114,180,810
Land, buildings, etc.....	700,056,050	38,173,000
Rubber.....	49,485,000	800,000
Shipping.....	33,604,895	4,315,225
Miscellaneous.....	336,152,776	21,497,000
Municipal.....	1,271,779,485	46,156,232
Canadian brought out in U. S.....	38,658,000	96,797,000
U. S. territories and possessions.....	8,815,000	
Foreign governments.....	601,781,000	134,600,000
Farm loan issues.....	127,353,100	19,527,900
Canadian corporations.....	85,195,000	21,016,000
Other foreign corporations.....	388,765,000	
Totals.....		

23. J. L. Dix operated a retail hardware store for a year and at the end of that time wished to know his net profit or loss from the operation of the store. His records showed that his total sales for the year were \$20,904.78. During the year he purchased merchandise for \$14,562.75, but at the end of the year he had on hand merchandise worth \$3,487.55. The total expenses for operating the business were \$6,752.06. (a) What was the gross profit? (Gross profit is the difference between the total sales and the cost of goods sold.) (b) What was his net profit? (Net profit is the difference between the gross profit and the operating expenses.)

24. The cost of operating a bus line between two cities during August was as follows: labor, \$327.65; gasoline, \$299.40; repairs, \$22.50; depreciation, \$250. The income from passenger fares during the period was \$1,146.83. (a) Did the bus company lose or gain through its operations? (b) How much?

25. Bruce Brothers operated five stores in the same city. Store No. 1 reported a gross profit of \$8,275.13 and expenses of \$5,215.29. Store No. 2 reported a gross profit of \$4,319.75 and expenses of \$4,977.15. Store No. 3 reported a gross profit of \$10,258.95 and expenses of \$6,988.12. Store No. 4 reported a gross profit of \$5,119.35 and expenses of \$4,835.76. Store No. 5

reported a gross profit of \$7,915.19 and expenses of \$6,010.50. Find the total net profit of the five stores.

26. The trial balance given below was prepared from a ledger which is in balance; but the trial balance is not in balance, because the bookkeeper failed to transfer from the ledger the amount of the sales returns, that is, the total of the various amounts of merchandise returned by customers. Copy the trial balance, writing *Sales Returns* between *Sales* and *Purchases*, and leaving the space for the amount blank. Add each column and find the difference. Write this difference in the column that is smaller and on a line with *Sales Returns*. The totals of the two columns of the trial balance should now be the same. This proves that the ledger is in balance.

COOK AND DUGGAN

TRIAL BALANCE, DECEMBER 31, 19...

Ledger Page		Debit	Credit
1	Cash.....	1,532 17	
1	Notes Receivable.....	1,345 65	
2	Accounts Receivable.....	2,353 01	
2	Reserve for Doubtful Accounts.....	10 01	19 19
3	Inventory.....	2,198 71	
4	Furniture and Fixtures.....	684 00	
4	Reserve for Depr. of Furn. and Fix. .		34 20
6	Buildings.....	6,000 00	
6	Reserve for Depreciation of Buildings		345 00
7	Land.....	4,000 00	
8	Office Supplies.....	301 25	
8	Insurance.....	190 96	
9	Notes Payable.....		1,795 82
9	Accounts Payable.....		2,081 39
11	Charles Cook, Capital.....		5,000 00
11	Thomas Duggan, Capital.....		5,000 00
12	Sales.....		26,783 12
15	Purchases.....	20,280 51	
15	Purchases Returns and Allowances . .		411 85
16	Selling Expense.....	1,520 65	
17	Administrative Expense.....	1,325 83	
18	Interest Earned.....		151 11
18	Purchases Discount.....		520 36
19	Interest Cost.....	91 72	
19	Sales Discount.....	64 75	

CHAPTER 7

BUSINESS PRACTICE

Banking. A bank is a business organized for the purpose of dealing in money and securities. One of the functions of a bank is to provide a safe place for money belonging to the bank and to others, and a convenient means of paying this money either to the owner or to others, as directed by him. Money belonging to a bank and to those who have left it there for safe-keeping is loaned to business men who wish to borrow and are willing to pay for the use of the money borrowed. The interest received for the use of the money loaned constitutes the principal income of a bank. Banks are operated under the supervision of the state or federal laws; this supervision is for the protection of the depositors.

One who leaves money with a bank for safe-keeping is known as a *depositor*; the money placed in a bank by a depositor is known as a *deposit*. A *deposit ticket* is a blank form provided by a bank for the convenience of its depositors in listing the cash or cash items to be deposited in the bank. A *check* is a blank form provided by the bank for the convenience of its depositors in withdrawing the funds deposited with it.

The illustration at the right shows a deposit ticket on which cash and cash items are listed. Cash includes paper money, gold, silver, and small change; cash items include bank checks. It is customary to arrange the currency in the order of the denominations, with the smaller denominations on top, and to place small change in coin envelopes made to contain 50 pennies, 40 nickels, 50 dimes, or 40 quarters. Each check deposited is listed separately. The name of the city is written at the left if the check is drawn on a bank in another city; the name of the bank,

DEPOSITED IN		
THE PEOPLES BANK OF ERIE		
By <u>James Madison</u>		
	ERIE, PA. <u>Jan. 12</u> 19	
PLEASE LIST EACH CHECK SEPARATELY		
	DOLLARS	CENTS
CURRENCY	100	
GOLD		
SILVER	56	52
CHECKS		
<u>Chicago, Ill.</u>	133	40
<u>Denver, Colo.</u>	93	60
<u>Cincinnati, O.</u>	66	22
<u>Springfield, Ill.</u>	110	20
<u>Detroit, Mich.</u>	127	86
<u>First National</u>	450	76
<u>State National</u>	17	62
	1156	18

if the check is payable in the same city. There are no universal rules applicable to the preparation of a deposit ticket, the details depending upon the regulations of the bank in which the deposit is made. You are advised to consult the receiving teller regarding the listing of deposits should you have occasion to deposit money in a bank. The receiving teller gives the depositor a receipt by writing the amount of each deposit in the latter's pass book. This pass book is a small memorandum book provided by the bank.

The blank checks provided by a bank are usually bound in a book, each check being attached to a stub. The book may contain one or more checks to the page. The illustration given below shows a check book with two checks to a page. A stub is provided for each check in order that the depositor may have a permanent record of the checks he has issued. The bank account is kept on the stub by adding each deposit and subtracting each check. The record on the check stubs should correspond with the record on the books of the bank when all the checks have been paid.

Deposit, <u>10</u> 3000 No. <u>1</u> Date <u>Jan 5</u> 19 For <u>Loretto M. Willenborg</u> For <u>the full of acct</u> Amount, \$ <u>53.75</u> Balance <u>2946.25</u>		<u>No. 1</u> <u>Jan 5 19</u> MERCHANTS NATIONAL BANK Pay to the order of <u>Loretto M. Willenborg</u> \$ <u>53.75</u> <u>Fifty three & 75/100</u> Dollars <u>James Madison</u> By <u>Student</u>
Deposit, _____ No. <u>2</u> Date <u>Jan 5</u> 19 For <u>P. A. Mortenson</u> For <u>cash purchase</u> Amount \$ <u>200.00</u> Bal. Carried Forward <u>2746.25</u>		<u>No. 2</u> <u>Jan 5 19</u> MERCHANTS NATIONAL BANK Pay to the order of <u>P. A. Mortenson</u> \$ <u>200.00</u> <u>Two Hundred & 00/100</u> Dollars <u>James Madison</u> By <u>Student</u>

In the first check James Madison ordered the Merchants National Bank to pay \$53.75 to Loretto M. Willenborg. The record of this check on the stub indicates that Mr. Madison owed Miss Willenborg and that the check was issued in payment of the amount owed. The stub also indicates that before writing the check Mr. Madison had \$3,000 in the bank, but after it was written he had only \$2,946.25 against which checks could be drawn.

In the second check Mr. Madison ordered the bank to pay \$200 to P. A. Mortenson. The record on the check stub shows that Mr. Madison bought some merchandise from Mr. Mortenson and that this check was given in payment of it. The check stub also shows that after the check was written Mr. Madison had \$2,746.25 against which checks could be drawn.

The depositor should state the information in the check in such a manner that it cannot be changed. If the amount of the check is changed through

carelessness on the part of the depositor, the bank will not be responsible. There are available many machines which insert the amount in a check in a way that insures that the amount to be paid when the check is presented to the bank is that which the depositor intends to be paid.

A *bank statement* is a form rendered monthly by the bank to each depositor. It contains a list of the deposits made by the depositor, the amount of each check issued by the depositor and paid by the bank, and the balance the depositor has in the bank. This balance may not be the same as that shown in the depositor's record on the check stubs, because all checks issued by the depositor may not have been presented to the bank for payment. Since the bank will return to the depositor with the statement all checks it has paid, the depositor can easily reconcile his balance with the bank's balance by checking the canceled checks with the stubs. The total of the checks not paid should be the difference between the balance shown by the bank and the balance shown by the depositor's record. The illustration on page 37 shows the form of monthly statement rendered by a bank.

EXERCISE No. 17, TRANSACTIONS WITH A BANK

1. During the month of January, the Mills Restaurant Company performed the following transactions with the Merchants National Bank:

Jan. 2. Deposited \$1,476.52.

4. Issued check No. 1 for \$35.

6. Issued check No. 2 for \$47.96.

7. Issued check No. 3 for \$74.87.

9. Issued check No. 4 for \$13.55.

10. Deposited \$1,231.99.

10. Issued check No. 5 for \$206.48.

12. Issued check No. 6 for \$198.54.

13. Issued check No. 7 for \$54.25.

14. Issued check No. 8 for \$75.40.

16. Issued check No. 9 for \$146.14.

17. Deposited \$917.45.

19. Issued check No. 10 for \$255.80.

23. Issued check No. 11 for \$87.87.

24. Issued check No. 12 for \$205.75.

24. Deposited \$1,006.38.

25. Issued check No. 13 for \$19.20.

26. Issued check No. 14 for \$185.95.

Williamson, James K.,

IN ACCOUNT WITH

THE FIFTH-THIRD NATIONAL BANK

OF CINCINNATI, OHIO.

REPORT PROMPTLY ANY CHANGE IN YOUR ADDRESS

PLEASE EXAMINE AT ONCE IF NO ERROR IS REPORTED WITHIN TEN DAYS THE ACCOUNT WILL BE CONSIDERED CORRECT

15

VOUCHERS RETURNED

DATE	CHECKS IN DETAIL				DATE	DEPOSITS
BALANCE BROUGHT FORWARD					Sept. 1	\$613.28
Sept. 1	100.00	20.00	6.25			
9	1.00	2.08			Sept. 10	150.00
15	6.00	21.76	9.13			
	1.82					
20	16.19	50.00			Sept. 20	50.00
					Sept. 25	150.00
30	12.50	16.50	19.00			
	101.28					
					BALANCE	\$579.77

THIS BANK INVITES YOU

TO OPEN A SAVINGS ACCOUNT.
TO RENT A SAFE DEPOSIT BOX IN OUR SAFETY VAULTS.
TO PATRONIZE OUR BOND TRAVEL AND FOREIGN DEPARTMENTS

This statement was prepared by The Fifth-Third National Bank as a record of its transactions with James K. Williamson. The amounts shown on the left side are checks which have been paid by the bank. The entry of September 1 shows three checks paid, \$100, \$20, \$6.25; that of September 9, two checks, \$1, \$2.08; etc.

The amounts on the right show the money on hand at the beginning of the month and that deposited during the month. The first entry on the right shows a balance of \$613.28 on September 1. The second entry on the right is a deposit of \$150 on September 10; the third, a deposit of \$50 on September 20; and the fourth, a deposit of \$150 on September 25.

The balance, \$579.77, is ascertained by subtracting the total of the checks from the sum of the deposits and the balance on hand at the beginning of the month. The depositor compares the canceled checks with his check stubs, indicating by check marks on the stub those checks which have been returned. If one or more checks drawn on the bank have not been presented for payment, the balance on the depositor's check stub will be different from that shown by the bank, the difference being the total of the unpaid checks. Comparing the bank statement with the depositor's record is known as the *reconciliation* of the bank account.

- 27. Issued check No. 15 for \$3.65.
- 28. Issued check No. 16 for \$125.60.
- 31. Issued check No. 17 for \$210.35.
- 31. Deposited \$1,158.64.

You are required to show: (a) the balance in the bank after each deposit is added and each check written; (b) the reconciliation of the bank balance, \$4,120.01, shown by the monthly bank statement, with checks Nos. 9, 15, and 16 unpaid.

2. The C. M. Yoder Laundry Machinery Company deposited the following cash and cash items in the Lincoln National Bank of Rochester, New York, on May 6:

Currency, \$122

Silver, \$7.65

Check on a bank in Dallas, Texas, \$275.55

Check on a bank in Fresno, California, \$257.40

Check on a bank in Tacoma, Washington, \$800

Check on a bank in Bangor, Maine, \$375.44

Check on a bank in Atlanta, Georgia, \$442.18

Check on a bank in Miami, Florida, \$627.86

Check on a bank in New Orleans, Louisiana, \$12.50

Check on a bank in Owensboro, Kentucky, \$562.75

Prepare a deposit ticket similar to that in the illustration.

3. On July 1, H. A. Porter received a statement from the City National Bank showing his balance to be \$1,456.85. This was \$200 more than the balance shown on the check stubs, because check No. 71, written on June 30, had not been paid by the bank. During the month of July he performed the following transactions with the bank:

July 3. Issued check No. 72 for \$50.

5. Issued check No. 73 for \$17.85.

7. Issued check No. 74 for \$846.55.

9. Deposited \$256.40.

11. Issued check No. 75 for \$208.62.

15. Issued check No. 76 for \$13.15.

17. Deposited \$144.67.

18. Issued check No. 77 for \$36.55.

21. Issued check No. 78 for \$175.

- 25. Deposited \$150.
- 28. Deposited \$18.55.
- 28. Issued check No. 79 for \$55.60.
- 30. Issued check No. 80 for \$98.47.

On August 1 he received from the bank a statement showing a balance of \$403.15. All checks issued were returned except No. 80. Show the check stub calculations; then reconcile the bank balance with the balance shown on the check stubs. Report the amount of the discrepancy to the instructor for explanation.

4. L. Harrison deposited the following cash and cash items in the Cleveland National Bank, Cleveland, Ohio, on August 6:

Currency, \$250

Silver, \$37.58

Check on First National Bank, \$55.40

Check on a bank in Cincinnati, Ohio, \$128.65

Check on a bank in New York City, \$827.65

Check on a bank in Chicago, Illinois, \$247.85

Check on a bank in Milwaukee, Wisconsin, \$118.72

Prepare a deposit ticket for Mr. Harrison's deposit.

5. J. L. Miller deposited \$873 in the Farmers National Bank on October 1. During October, November, and December he performed the following transactions:

- Oct.
- 5. Issued check for \$46.35.
 - 5. Issued check for \$75.25.
 - 11. Issued check for \$104.56.
 - 15. Deposited \$645.
 - 18. Issued check for \$45.95.
 - 25. Issued check for \$203.33.

- Nov.
- 1. Deposited \$402.25.
 - 3. Issued check for \$55.23.
 - 7. Issued check for \$72.33.
 - 12. Issued check for \$25.50.
 - 15. Issued check for \$64.45.
 - 15. Issued check for \$25.48.
 - 20. Deposited \$105.45.
 - 25. Issued check for \$69.93.

- Dec. 1. Deposited \$809.96.
3. Issued check for \$55.25.
3. Issued check for \$25.42.
8. Issued check for \$14.15.
15. Deposited \$785.50.
18. Issued check for \$86.07.
28. Issued check for \$45.55.

On January 2 he received a statement from the bank showing that his balance was \$2,692.84 and that the checks issued on November 7 and December 8 were still unpaid. Show the check stub calculations; then reconcile the bank balance with the balance shown on the check stubs.

6. On January 2, H. D. Richards deposited \$476 in the First National Bank. During January and February he performed the following transactions:

- Jan. 3. Issued check for \$32.50.
5. Issued check for \$51.
7. Issued check for \$21.62.
16. Deposited \$92.65.
18. Issued check for \$15.
19. Issued check for \$42.75.
24. Issued check for \$56.

- Feb. 2. Deposited \$100.
4. Issued check for \$91.25.
10. Deposited \$76.30.
18. Issued check for \$37.90.
25. Issued check for \$15.75.
27. Deposited \$50.
28. Issued check for \$21.60.

On March 2 he received a statement from the bank showing that his balance was \$469.08 and that the checks issued on February 18 and February 28 were still unpaid. Show the check stub calculations; then reconcile the bank balance with the balance shown on the check stubs.

CHAPTER 8

BUSINESS PRACTICE

Cash account. A record of cash received and cash paid, made in the form illustrated below, is known as a *cash account*. The account form may also be used in recording other facts when one desires to indicate addition and subtraction by position.

CASH

19...				19...			
Feb.	1		1,000 00	Feb.	1		725 50
	2		25 50		2		50 00
	5		232 65		9		42 50
	10		118 45		10		137 50
	12		87 45		16		42 50
	17		112 65		18		187 50
	21		98 40		23		42 50
	24		109 20		25		13 50
	26		98 40		26		41 75
	28		88 90		28	Balance	✓ 688 35
			1,971 60				1,971 60
Mar.	1	Balance	✓ 688 35				

The illustration shows a record of the following transactions:

Feb. 1. C. H. Moore invested \$1,000 in a grocery.

NOTE: Cash received is recorded on the left side under the date on which it was received.

1. Paid \$725.50 for merchandise.

NOTE: Cash paid is recorded on the right side under the date on which it was paid.

2. Received \$25.50 for merchandise sold.

2. Paid \$50 for rent.

5. Received \$232.65 for merchandise sold.

9. Paid clerks \$42.50.

10. Received \$118.45 for merchandise sold.

10. Paid \$137.50 for merchandise purchased.

12. Received \$87.45 for merchandise sold.

16. Paid \$42.50 to clerks.
17. Received \$112.65 for merchandise sold.
18. Paid \$187.50 for merchandise purchased.
21. Received \$98.40 for merchandise sold.
23. Paid clerks \$42.50.
24. Received \$109.20 for merchandise sold.
25. Paid \$13.50 for merchandise purchased.
26. Received \$98.40 for merchandise sold.
26. Paid \$41.75 for merchandise purchased.
28. Received \$88.90 for merchandise sold.

The bookkeeping term used to describe the left side of an account is *debit*; the right side, *credit*; and the difference between the two sides, *balance*. The cash on hand should be the same as the balance, which is the difference between the total debits and the total credits. Ascertaining this fact is known as *proving cash*.

EXERCISE No. 18, CASH ACCOUNT

The following problems provide practice in recording transactions in account form. You are to enter the amounts on the debit or the credit side of the account, as in the illustration of the cash account or as instructed in the exercise.

1. D. A. Wells, a retail fruit merchant, performed the following cash transactions during the first week in June:

- June
1. Balance on hand, \$126.80. Paid rent, \$60; received from cash sales for the day, \$75.25.
 2. Paid for fruit and express, \$37.85; received from cash sales as shown by the cash register, \$49.19.
 3. Paid clerk, \$10; received from cash sales as shown by the cash register, \$39.14.
 4. Paid occupational tax, \$2.50; paid for fruit purchased, \$22.85; received from cash sales as shown by the cash register, \$22.19.
 5. Paid telephone bill, \$2.75; paid for fruit purchased, \$39.16; received from cash sales as shown by the cash register, \$41.77.
 6. Paid gas and electric bill, \$1.57; paid for fruit purchased, \$29.65; paid balance due clerk, \$7.50; received from cash sales, \$52.65.

Record these transactions in account form as illustrated on page 41. The balance on hand, each receipt, and the date of

each are entered on the left; each payment and the date are entered on the right. The balance of cash on hand should be the difference between the total debits and the total credits.

2. A. L. Graham completed the following cash transactions during the first fifteen days in March:

- Mar. 1. Invested \$3,500 in cash.
2. Paid for delivery truck, \$300.
3. Paid for office and store fixtures, \$650.
5. Received from cash sales, \$304.87; paid cash for merchandise, \$1,500.
6. Received from Caleb Brothers, \$50; paid sundry expenses, \$127.
7. Paid \$150 for safe; received from O. H. Arnold, \$64.
8. Paid cash for merchandise, \$330.75; received from cash sales, \$204.18.
9. Received from H. F. Ritter, \$15; paid cash for merchandise, \$28.65.
10. Received from cash sales, \$264.85; received from O. B. Donaldson, \$50.
12. Received from cash sales, \$15.79; paid the Belknap Hardware Co., \$629.87.
14. Paid sundry expenses, \$72.50; paid C. R. Crawford, \$75.
15. Received from H. F. Ritter, \$20; borrowed from the bank, \$1,000.

What was his cash balance on March 16?

3. A grocer completed the following transactions with a customer, Alvin Young. The grocer opened account with Mr. Young. He did this by writing the name, Alvin Young, above an account just as *Cash* appears above the account on page 41. He then recorded the date and the amount of each sale on the debit (left) side of the account, and the date and the amount of each cash receipt on the credit (right) side of the account. He also entered on the credit side the date and the amount of all goods returned for credit. The difference between the debits and the credits is the amount due from Mr. Young.

- Mar. 1. Purchased groceries, \$2.65.
5. Purchased groceries, \$9.87.
7. Purchased groceries, \$11.42.

9. Paid \$10 in part payment of previous purchases.
12. Purchased groceries, \$7.16.
13. Purchased groceries, 88c.
14. Purchased groceries, \$9.65.
16. Paid \$20 in part payment of previous purchases.
18. Purchased groceries, \$4.19.
21. Purchased groceries, \$7.15.
24. Returned 3 cans tomatoes at 35c each for credit.
25. Purchased groceries, \$1.65.
28. Purchased groceries, \$15.44.

How much did Mr. Young owe the grocer on April 1?

Record the preceding transactions in account form under the name Alvin Young. The balance due April 1 will be the difference between the total of the debits and the total of the credits.

NOTE: One who buys from a merchant on account, that is, one who promises to pay on the first of each month, will know the amount he owes the merchant if he keeps a record of the sales ticket or sales invoice which the merchant renders with each sale of merchandise. It is quite evident that the customer is interested in knowing that the facts set forth in the statement are correct. He should retain these invoices so that he can check the totals on them with the amounts in the statement, because there is always a possibility of the merchant's charging one customer for merchandise purchased by another.

4. The monthly sales and returned sales of the Fair Store during the year beginning with January were as follows:

- | | |
|-----------|--|
| Jan. 31. | Sales, \$11,642.91; returned sales, \$418.23 |
| Feb. 28. | Sales, \$ 9,487.25; returned sales, \$325.87 |
| Mar. 31. | Sales, \$13,587.44; returned sales, \$225.45 |
| Apr. 30. | Sales, \$13,795.53; returned sales, \$427.45 |
| May 31. | Sales, \$14,893.38; returned sales, \$362.25 |
| June 30. | Sales, \$12,374.85; returned sales, \$259.95 |
| July 31. | Sales, \$12,375.82; returned sales, \$343.73 |
| Aug. 31. | Sales, \$11,385.82; returned sales, \$389.92 |
| Sept. 30. | Sales, \$ 9,323.44; returned sales, \$258.45 |
| Oct. 31. | Sales, \$10,682.25; returned sales, \$268.43 |
| Nov. 30. | Sales, \$10,928.44; returned sales, \$284.42 |
| Dec. 31. | Sales, \$11,483.35; returned sales, \$325.55 |

Record the preceding transactions in account form under the title *Sales*. Enter the date and the total sales for each month on the credit side, and the date and the total returns on the debit

side. The balance, which is the difference between the two totals, will be the net sales made during the year.

5. Robert Browning, a clerk, receives a salary of \$300 a month. He wishes to keep a record of his income from his salary and of his living expenses so that he will know the excess of income over expenses. During the quarter ending March 31, his income and expenses were as follows:

- Jan. 2. Received December salary, \$300; paid rent, \$52.
- 2. Paid light bill, \$2.80; paid telephone bill, \$2.25.
- 15. Paid \$12.50 for clothing.
- 31. Paid \$38.65 for groceries and meat.
- Feb. 1. Received January salary, \$300; paid rent, \$52; paid insurance, \$113.85.
- 2. Paid for light, \$2.45; for telephone, \$2.25.
- 28. Paid \$32.45 for groceries and meat.
- Mar. 1. Received February salary, \$300; paid for clothing, \$35.80.
- 2. Paid for light, \$1.65; paid telephone bill, \$2.25.
- 15. Paid insurance on household furnishings, \$18.50.
- 18. Paid for house furnishings, \$55.75.
- 31. Paid \$35.60 for groceries and meat.

Record the preceding transactions in account form under the title *Income and Expenses*. Income is recorded on the credit side of the account, and expenses are recorded on the debit side. The difference between the total income and the total expenses is Mr. Browning's savings during the three months. On the left side under date of March 31, write *Savings* and the amount. Balance and rule the account in the same form as the cash account on page 41.

6. R. H. Norman, a farmer, wishes to keep a record of the sales of chickens and eggs and of his expenses in connection with the upkeep of the poultry. During the first six months of the year, he completed the following transactions:

- Jan. 2. Purchased poultry, \$126.50.
- 7. Sold chickens and eggs, \$12.65.
- 11. Paid for feed, \$3.50.
- 15. Sold chickens and eggs, \$18.75.
- 18. Paid for feed, \$4.50.
- 24. Sold chickens and eggs, \$15.50.
- 27. Paid for feed, \$2.25.

- Feb. 6. Sold chickens and eggs, \$16.45.
8. Purchased poultry, \$45.50.
10. Paid for feed, \$1.75.
18. Sold chickens and eggs, \$21.45.
21. Paid for feed, \$3.
25. Sold chickens and eggs, \$19.65.
28. Paid for feed, \$1.25.
- Mar. 8. Sold chickens and eggs, \$20.55.
10. Paid for feed, \$2.55.
19. Sold chickens and eggs, \$22.75.
21. Paid for feed, \$3.25.
27. Sold chickens and eggs, \$21.50.
29. Paid for feed, \$1.75.
- April 2. Sold chickens and eggs, \$22.55.
3. Paid for feed, \$3.
15. Sold chickens and eggs, \$17.50.
18. Paid for feed, \$3.25.
26. Sold chickens and eggs, \$18.95.
29. Paid for feed, \$2.25.
- May 8. Sold chickens and eggs, \$21.75.
9. Paid for feed, \$2.50.
17. Sold chickens and eggs, \$23.50.
19. Paid for feed, \$1.50.
24. Sold chickens and eggs, \$12.45.
27. Paid for feed, \$1.75.
- June 6. Sold chickens and eggs, \$15.50.
19. Sold chickens and eggs, \$14.75.
20. Paid for feed, \$2.15.
26. Sold chickens and eggs, \$12.95.
27. Paid for feed, \$1.25.
30. Sold all chickens and eggs on hand for \$129.50.

You are to record in account form under the title *Poultry Income and Expense* the transactions outlined above. The cost of the chickens and the feed should be recorded on the debit side; and the amounts received from sales, on the credit side. The balance will be the net income; that is, the cash received in excess of the cash paid. When you have ascertained the profit, enter this on the debit side under date of June 30 and rule the account.

UNIT 3

MULTIPLICATION

CHAPTER 9

PRINCIPLES AND DRILLS

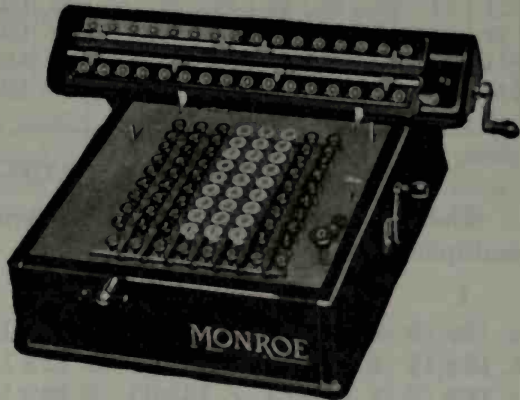
Multiplication is a short method of addition. The *product* is the result obtained by multiplication and is the same as the sum, if the process were by addition.

The *multiplicand* and the *multiplier* are the factors of the product. In other words, the multiplicand is the number to be added, and the multiplier the number of times it is to be added. If the number to be added refers to some specific article, it is quite evident that the product obtained by adding the desired number of times refers to the same article.

The process of multiplication when applied to business problems is usually indicated by writing the word *at* or the symbol @ between the multiplier and the multiplicand. Sometimes in invoices in which a statement of the facts indicates multiplication, the word *at* or the symbol may be omitted.

"10 lbs. of coffee at 35c" is equal to 35 multiplied by 10; the product is \$3.50 because 35c is added ten times. When the price applies to a specific quantity the word *at* is omitted: "10 lbs. salt, 75c" indicates that the selling price of the entire quantity is 75c.

Accuracy in multiplication is of great importance, especial-



Calculating Machine

A machine of this kind may be used in solving problems, but business demands speed and accuracy in solving problems without the machine, for frequently a machine is not available or cannot be used quickly.

ly in the solution of those business problems which relate to the amounts of sales. If the multiplication is incorrect, either the buyer or the seller loses if the error is not discovered.

You purchased from the butcher 9 lbs. of meat at 29c a lb., and gave him a five-dollar bill in payment. He made an error of 10c in his calculations, recording the amount as \$2.51 instead of \$2.61, and gave you change accordingly. At the end of the day he proved his record of cash by counting the cash in the cash register. This error of 10c was not detected by his proof, because the amount of the sale recorded and the amount of the cash received, which serve as a proof of his cash record, were the same.

EXERCISE No. 19, THE MULTIPLICATION TABLE

The table given below is to provide oral practice in the multiplication of numbers up to and including 15, multiplied by 15.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
11	22	33	44	55	66	77	88	99	110	121	132	143	154	165
12	24	36	48	60	72	84	96	108	120	132	144	156	168	180
13	26	39	52	65	78	91	104	117	130	143	156	169	182	195
14	28	42	56	70	84	98	112	126	140	154	168	182	196	210
15	30	45	60	75	90	105	120	135	150	165	180	195	210	225

EXERCISE No. 20, MULTIPLICATION

The following problems are to provide further oral drill in multiplication.

1	2	3	4	5	6
a. 15×9	a. 14×13	a. 15×12	a. 15×13	a. 12×11	a. 15×8
b. 13×11	b. 7×15	b. 14×8	b. 12×11	b. 13×12	b. 7×11
c. 14×7	c. 12×13	c. 13×11	c. 13×14	c. 14×13	c. 13×15
d. 11×15	d. 14×12	d. 9×14	d. 14×12	d. 13×13	d. 14×9
e. 15×7	e. 12×15	e. 14×11	e. 13×7	e. 11×15	e. 9×15
f. 9×12	f. 13×11	f. 13×9	f. 12×11	f. 13×11	f. 12×11

EXERCISE No. 21, PROCESS AND PROOF OF MULTIPLICATION

Multiplication is a short-cut process of addition; hence, the product can be proved in the same manner as the sum in addition, that is, by a reverse process. The illustration given below shows the process of multiplication and the proof by reverse multiplication, applied to the problem of 671 multiplied by 196.

$$\begin{array}{r}
 671 \\
 196 \\
 \hline
 4026 \\
 6039 \\
 671 \\
 \hline
 131516
 \end{array}$$

You will observe that the multiplier and the multiplicand are reversed in order to prove by reverse multiplication. It is better when proving by this method to make the calculations on a separate sheet of paper and then to compare the results.

$$\begin{array}{r}
 196 \\
 671 \\
 \hline
 196 \\
 1372 \\
 1176 \\
 \hline
 131516
 \end{array}$$

The following problems provide practice in multiplication. You are to show the process of multiplication, with the multiplicand written above the multiplier, and the proof by the reverse method, with the multiplicand written below the multiplier.

1	2	3	4
a. $2,792 \times 347$	a. $6,453 \times 999$	a. $3,765 \times 2,839$	a. $7,837 \times 4,723$
b. $3,806 \times 342$	b. $4,700 \times 387$	b. $4,274 \times 3,746$	b. $1,238 \times 3,746$
c. $4,785 \times 617$	c. $8,876 \times 427$	c. $3,989 \times 1,894$	c. $8,132 \times 7,325$
d. $8,293 \times 723$	d. $9,423 \times 471$	d. $4,563 \times 8,139$	d. $2,736 \times 4,635$

EXERCISE No. 22, TEN OR A MULTIPLE OF TEN

When the multiplier is 10 or a power of 10, the product is ascertained by adding as many ciphers to the multiplicand as there are ciphers in the multiplier. If dollars and cents are involved, the two right-hand figures in the product will be cents and the figures at the left of the cents will be dollars. The following problems provide oral practice in multiplying by 10 or a multiple of 10.

1	2	3
a. $\$67,719 \times 10$	a. $\$37.94 \times 10$	a. $\$132.40 \times 1,000$
b. $\$58,836 \times 10$	b. $\$57.78 \times 10$	b. $\$105.55 \times 1,000$
c. $\$47,537 \times 10$	c. $\$67.25 \times 100$	c. $\$156.25 \times 1,000$
d. $\$58,375 \times 10$	d. $\$375.89 \times 100$	d. $\$178.27 \times 1,000$
e. $\$45.35 \times 10$	e. $\$928.38 \times 100$	e. $3,725 \times 100$
f. $\$78.87 \times 10$	f. $\$747.38 \times 100$	f. $8,740 \times 1,000$

EXERCISE No. 23, NINETY-NINE OR ONE HUNDRED ONE

When the multiplier is 99 or 101, the product may be ascertained in the first case by multiplying by 100 and subtracting the amount of the multiplicand, or in the second case by multiplying by 100 and adding the amount of the multiplicand.

$$786 \times 99 = 77,814;$$

$$786 \times 101 = 79,386;$$

$$786 \times 99 = 78,600 - 786 = 77,814. \quad 786 \times 101 = 78,600 + 786 = 79,386.$$

The same process will apply when the multiplier is 999 or 1,001, but in business problems 99 and 101 will be used more frequently. This process might be extended to include 102, 103, 104, etc., but it is better to follow the usual process, because the application of the short-cut method would be more difficult.

When the multiplier is 99 or 101 and dollars and cents are involved, the two right-hand figures in the product will be cents and the figures at the left of the cents will be dollars. The following problems provide practice in applying this procedure.

1	2	3
a. $48,572 \times 99c$	a. $8,275 \times 101$	a. $3,465 \times \$1.01$
b. $67,392 \times 99c$	b. $4,738 \times 101$	b. $7,836 \times \$1.01$
c. $78,473 \times 99c$	c. $5,647 \times 101$	c. $6,927 \times \$1.01$
d. $92,837 \times 99c$	d. $4,738 \times 101$	d. $8,947 \times \$1.01$
e. $47,384 \times 99c$	e. $2,938 \times 101$	e. $7,725 \times \$1.01$
f. $92,837 \times 99c$	f. $9,384 \times 101$	f. $5,427 \times \$1.01$

CHAPTER 10

PRACTICAL PROBLEMS

1. Ascertain the total amount necessary to purchase the following items. Show the amount of each purchase and the total.

2 doz. eggs at 49c	1 bx. aspirin at 39c
3 lbs. coffee at 48c	1 bottle listerine at 79c
5 lbs. meat at 39c	2 pkgs. figs at 18c
11 yds. percale at 29c	15 lbs. parsnips at 5c
25 lbs. sugar at 9c	12 lbs. apples at 4c
24 lbs. sweet potatoes at 6c	20 lbs. potatoes at 6c

2. The Dry Fuel Company bought 500 cords of wood at \$11 a cord. It sold 200 cords at \$14, 100 cords at \$14.75, and the remainder at \$10 a cord. (a) Did it gain or lose? (b) How much? (c) If the expense of delivery was 25c a cord, what was the net gain or loss?

3. You are given a \$5 bill to purchase from a grocery store the following items: 10 lbs. of sugar at 5c; 1 loaf of bread at 10c; 2 lbs. of prunes at 15c a lb.; 2 lbs. of butter at 32c a lb.; and 2 cans of peaches at 38c each. What amount of change should you receive, and in what denominations?

4. A. Y. Burroughs lives at the corner of Main and Oak Streets. His lot fronts 100 feet on Main Street and 200 feet on Oak Street. What will it cost at \$1.05 a foot to erect a wire fence between him and his neighbors on the side and on the back?

5. What will it cost, at \$2 a square yard, to put down a new cement sidewalk 4 feet wide on both Oak and Main Streets?

6. He has a back porch which is 15 feet long and 5 feet wide. What will the lumber for reflooring cost at \$42.50 a thousand feet? The floor is one inch in thickness. Each piece is six inches wide, but since it is tongued and grooved, only five inches of surface is obtained out of each six-inch width.

NOTE: A board foot is one foot wide, one foot long, and one inch thick. Thus a board 15 feet long, 6 inches wide, and 1 inch thick contains $7\frac{1}{2}$ board feet.

7. A grocer bought five bags of coffee weighing: 123 lbs., 132 lbs., 129 lbs., 127 lbs., 133 lbs., at 14c a pound, and sold it at 17c a pound. You are required to show: (a) the cost of the coffee; (b) the selling price of the coffee; and (c) the profit.

8. H. M. Clark purchased a farm containing 640 acres at \$60 an acre. After paying \$3,250 for improvements, he sold the farm for \$45,382. You are to show: (a) the cost of the farm plus the cost of the improvements, and (b) the profit.

9. The average yield of a field of wheat was 38 bushels an acre. What was the total yield if the field contained 48 acres?

10. The following advertisement of bargains appeared in a daily newspaper of a certain large city.

Quantity	Article	Marked Price	Sale Price
1,415 Yds.	Plain and Fancy Satin Taffetas, Tub Silks and Rayon Fabrics, per yard	\$1.89	\$1.10
975 Yds.	Crepe de Chine, Taffeta, Satin Foulards, Tub Silk, etc. Special, per yard	\$2.25	\$1.25
795 Yds.	Knitted Rayon Tricolet, black and navy, for dresses, slips, per yard	\$1.25	65c
375 Yds.	50- and 54-inch Satin Crepe and Flat Crepes, plain and novelty borders, fine quality, per yard	\$3.75	\$2.95
575 Yds.	Satin Crepe, Flat Crepe, Canton Crepe, etc., per yard	\$3.50	\$1.85
425 Yds.	39-inch Black Satin Charmeuse, supple quality. Special, per yard	\$1.98	\$1.45
1,000 Yds.	Japanese Pongee Silk, 33 inches wide, 12 momme. Special, per yard	79c	57c
2,300 Yds.	Lining Remnants—a vast accumulation of odds and ends, per yard	69c	25c
400 Yds.	50-inch All-Wool Chiffon Broadcloth—light and dark colors, per yard	\$3.50	\$2.48

You are to ascertain: (a) the amount received for this merchandise, assuming that all of it was sold during the sale; and (b) how much more would have been received if the merchandise had been sold at the marked price?

CHAPTER 11

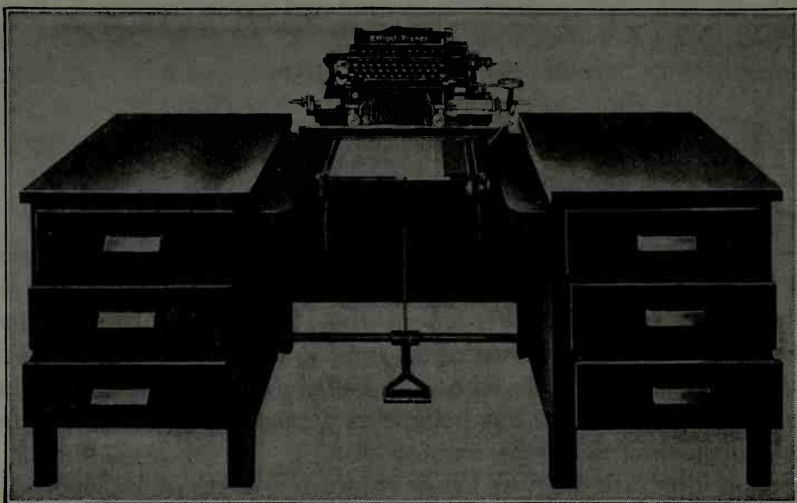
BUSINESS PRACTICE

Billing. The preparation of the invoice by the seller is known as *billing*. When merchandise is sold, the buyer receives in addition to the merchandise a list of the merchandise he has purchased. This list is known as an *invoice*; in the retail business it is sometimes referred to as a *sales ticket*. The buyer regards the list of goods which he has bought as a *purchase invoice*, and the seller regards it as a *sales invoice*.

The illustration given below shows one form of invoice. In addition to the list of merchandise which changed hands, the invoice contains the date, the name and the address of the buyer, the name and the address of the seller, the terms, and the method of delivery. The invoice may also contain any other information which the seller may wish it to show.

H. L. RICHESON & CO. CASH WHOLESALE GROCERS 521 EAST FIRST STREET			
 SUGAR KINGS			
DAYTON, OHIO October 15, 19			
SOLD TO W. R. Swanson Grocery Co. 3612 Creighton Ave., Dayton, Ohio.		DATE	
TERMS Net 10 days OUR ORDER No. S 11161		YOUR ORDER No. 112	
		DELIVERED Via Truck	
600 lbs. 300 lbs. 120 lbs. 6 doz. 10 doz.	Granulated Sugar (6 sacks, 100 lbs. each) Domino Sugar (2 pound cartons) Confectionery Sugar (1 pound cartons) cans Peaches (3 cases) cans Corn (5 cases)	cwt. 5.75 cwt. 6.25 cwt. 7.50 doz. 2.50 doz. 2.00	34 50 18 75 9 00 15 00 20 00 97 25

Accuracy is essential in ascertaining the value of merchandise sold, because an error in the invoice means a loss to either the buyer or the seller.



Billing Machine

A machine of this kind is sometimes used in preparing invoices. It is especially desirable when a number of carbon copies are needed.

EXERCISE No. 24, BILLING

The following problems provide practice in billing different kinds of merchandise. Prove the correctness of the multiplication of each extension and the addition of the invoice.

1. Ward & Co. sold the H. C. Capwell Co.:

15 bolts of percale at \$4.85
 18 yards of velvet at \$3.75
 8 bolts of domestic cotton at \$4.40
 39 bolts of binding tape at 31c
 25 bolts of sheeting at \$15
 80 yards of flannel at \$1.98

NOTE: The price given applies to each unit of the quantity mentioned. Thus, if the quantity is given as 15 bolts, the price stated is for a bolt and not for a yard.

2. The National Grocery Co. sold A. Larenson:

12 dozen bars of Palmolive soap at 53c
 15 dozen cans of tomatoes at \$1.35
 6 dozen cans of California peaches at \$2.42
 5 dozen cans of asparagus at \$3.05
 9 dozen cans of cherries at \$2.25
 25 dozen Del Monte Alaska salmon at \$2.05

3. Barton Bros. sold the Reynolds Grocery Co.:
 - 1,263 pounds (3 barrels) granulated sugar at 7c
 - 656 pounds (2 barrels) brown sugar at 6c
 - 400 pounds (16 sacks) granulated sugar at 8c
 - 225 boxes Domino sugar at 21c
 - 82 boxes powdered sugar at 88c
 - 35 boxes powdered sugar at 55c
4. The T. B. Bridges Co. sold J. W. Brown:
 - 855 pounds of leaf lard at 19c
 - 125 pounds of breakfast bacon at 35c
 - 416 pounds of ham at 27c
 - 125 pounds of premium butter at 45c
 - 227 pounds of chicken at 43c
 - 516 pounds of bacon sides at 16c
5. The Modern Mfg. Co. sold the Maxwell Hardware Co.:
 - 25 Racing cars at 25c
 - 35 Crazy cars at 79c
 - 42 Automobiles at 62c
 - 35 "Spark Plugs" at 95c
 - 24 "Bucking Bronchos" at 84c
 - 15 "Tut-Tuts" at \$1.05
 - 24 Dancing Dolls at 24c
6. The Pacific Fur Co. sold the Jackson Co.:
 - 16 mahogany smoking cabinets at \$2.48
 - 8 buffet mirrors at \$7.65
 - 15 reed rockers at \$11.25
 - 35 oak chairs at \$1.35
 - 52 oak rockers at \$2.25
 - 24 kitchen tables at 98c
 - 12 bentwood chairs at \$4.20

EXERCISE No. 25, AUDITING

The seller should retain a copy of each invoice which he renders to facilitate an adjustment in case there is a misunderstanding, or in case the buyer wants to return some of the merchandise. This copy is usually made by using carbon paper.

The following problems represent the extensions on carbon copies of invoices rendered. A variety of merchandise is represented to familiarize you with merchandise sold by different lines of business. You are to verify each extension, to prepare a written

solution of those which are not correct, and to show the correct total of all the amounts.

	<i>Item</i>	<i>Price</i>	<i>Amount</i>
a.	38 pocket knives.....	\$.32	\$ 12.16
b.	66 pocket knives.....	.46	30.36
c.	42 Gillette razors.....	.88	36.06
d.	15 barrels of flour.....	7.25	108.25
e.	9 family tool chests.....	8.69	78.21
f.	12 dozen boys' tan shoes.....	12.65	153.80
g.	21 unbreakable "Mama Dolls" ..	1.69	35.49
h.	48 dozen Ivory soap.....	.68	32.64
i.	8 Samson Electric Irons.....	5.95	47.60
j.	15 kiddy scooters.....	1.65	24.25
k.	165 pounds of Red Ribbon butter.	.45	74.25
l.	16 dozen pairs men's silk socks..	7.65	132.40
m.	48 dozen dolls.....	9.99	479.52
n.	21 Universal Babymikes.....	7.50	157.50
o.	468 pounds of breakfast bacon..	.32	149.76
p.	45 cases Safe Home matches....	5.75	258.75
q.	35 dozen pairs ladies' hose.....	6.55	239.25
r.	655 pounds (25 kegs) 10d nails..	.07	45.85
s.	25 pairs kid gloves.....	2.75	68.25
t.	15 smoking jackets.....	4.95	74.25
u.	31 detector amplifiers.....	1.85	56.35
v.	7 portable victrolas.....	22.95	160.65
w.	525 sacks of salt.....	.05	26.25
x.	45 boxes of Red Cross soap.....	2.95	163.25
y.	28 kiddies road rippers.....	7.35	205.80
z.	56 men's ribbed sport coats.....	2.98	166.88
aa.	125 wooden cases.....	.85	106.25
bb.	48 pounds of Jones' sausage.....	.48	23.04
cc.	8 Aragon battery chargers.....	12.35	96.60
dd.	8 Universal hammers.....	.88	7.04
ee.	48 bath towels.....	.79	35.92
ff.	92 kitchen tables.....	.98	90.16
gg.	250 natural "Mama Dolls".....	.99	247.50
hh.	42 girls' moccasin style slippers..	1.01	42.42
ii.	250 boxes Iodized Salt.....	.12	3.00
jj.	31 boxes Crane's Stationery #16	.57	17.67
	Total.....		

EXERCISE No. 26, INVENTORY

The merchant buys merchandise and places it in stock for the convenience of his customers who wish to purchase it. At various times, usually at the end of each year, he ascertains the value of all merchandise he has in stock. This process is known as *taking stock*, and the list of merchandise resulting therefrom as an *inventory*. The inventory contains a list of the merchandise and the prices, usually cost, or market if those prices are less than cost.

1. R. T. Foreman, a retail grocer, had in stock on January 31 the merchandise given in the following inventory. Write the amount of each extension, add, and show the total.

INVENTORY, JANUARY 31, 19..

173 lbs. Granulated Sugar.....	\$.06	
196 lbs. Brown Sugar.....	.05	
2 doz. Ivory Soap.....	.35	
2 doz. Blacking.....	.32	
26 lbs. Arbuckle Coffee.....	.18	
15 lbs. Tea.....	.27	
41 gal. Coal Oil.....	.10	
656 lbs. Bacon.....	.20	
500 lbs. Ham.....	.24	
1,388 lbs. Shoulder.....	.21	
117 lbs. Lard.....	.19	
24 doz. Cans Tomatoes.....	2.00	
35 gal. Syrup.....	.80	
5 bags Irish Potatoes.....	1.95	
25 bbls. White Lily Flour.....	8.85	
37 bbls. Fancy Flour.....	7.30	
78 lbs. Red Ribbon Butter.....	.35	
96 doz. Eggs.....	.40	
Total.....		

2. The Divine Piano Company had the following merchandise in stock on December 31: 187 music rolls @ 65c; 37 music rolls @ 80c; 29 music rolls @ \$1; 67 music rolls @ \$1.25; 215 pieces of music @ 16c; 118 pieces of music @ 18c; 27 pieces of music @ 21c; 2 pianos @ \$272.50; 3 pianos @ \$315.50; 4 pianos @

\$450; 2 pianos @ \$550. Show: (a) the quantity, the description, the price, and the value of each kind of merchandise, and (b) the total value of all the merchandise.

3. The Jones Confectionery Company had in stock on June 30 the following merchandise: 12 1-lb. boxes Johnson's candy @ 72c a lb.; 14 2-lb. boxes Johnson's candy @ 72c a lb.; 16 5-lb. boxes Johnson's candy @ 72c a lb.; 15 boxes A1 cream chocolates @ 85c; 215 lbs. mixed candy @ 17c; 15 lbs. mints @ 42c. Find the total value.

4. The Regan Radio Company had the following supplies in stock on September 30: 3 Crosley Head Phones @ \$4.25; 8 Navy Head Phones @ \$7.60; 14 spools No. 26 Green Silk Wire @ 88c; 48 Porcelain Socket Tubes @ \$26.50 a doz.; 3 DeForest Amplifiers @ \$12.40; 5 DeForest Detectors @ \$21.50; 12 Crystal Cups @ 48c; 6 "A" Storage Batteries @ \$15.50; 14 Silvertone Jr. Loud Speakers @ \$17.50; 5 Music Box Crystal Sets @ \$6. Find the value of the inventory.

5—6. In the two problems given below, the figure in the first column represents the units, and that in the second column, the price of a unit. You are to ascertain the value of each quantity and the total value of all quantities.

5		6	
a.	88 @ \$.62	a.	347 @ \$.57
b.	269 @ .48	b.	714 @ .88
c.	478 @ .92	c.	279 @ .45
d.	527 @ .44	d.	826 @ .96
e.	686 @ .32	e.	559 @ 1.13
f.	541 @ .14	f.	673 @ 1.22
g.	722 @ .13	g.	821 @ .73
h.	361 @ 1.25	h.	87 @ 1.36
i.	462 @ 1.18	i.	129 @ 1.55

7 to 10. The figures in the first column of each of the following four problems represent the quantity; those in the second, the prices; and those in the third, the extensions. You are: (a) to audit these extensions; (b) to show in detail the calculations necessary to ascertain the correct amounts in those extensions which are wrong; and (c) to show the correct total of each problem.

NOTE: Unless the calculations are correct when a sale is made, the buyer or the seller will lose through the error. It is only fair that each should make the calculations and verify the amount of the sale. It is unfair to the buyer, if the seller observes an error in his favor and does not report it. It is just as unfair for the buyer to take advantage of the seller in the same way.

7

a. 315 bu.	\$1.10	\$346.50
b. 439 gal.	.59	249.01
c. 221 lbs.	.17	37.57
d. 17 lbs.	.22	3.74
e. 345 gal.	.78	279.10
f. 718 doz.	.88	632.84
g. 954 bu.	1.09	939.86
h. 87 gal.	.65	56.55
i. 231 doz.	.98	226.38
j. 652 bu.	1.50	978.00
k. 82 lbs.	.29	24.78
l. 110 lbs.	.15	16.50

8

a. 225 lbs.	\$.11	\$ 23.75
b. 13 bu.	1.50	19.50
c. 371 lbs.	.15	55.65
d. 413 lbs.	.10	42.20
e. 516 doz.	.25	128.00
f. 176 lbs.	.09	16.74
g. 654 bu.	1.10	719.40
h. 315 gal.	.79	248.85
i. 710 doz.	.35	258.60
j. 823 lbs.	.16	141.58
k. 238 lbs.	.13	30.94
l. 75 lbs.	.22	16.50

9

a. 217 bu.	\$1.10	\$238.70
b. 67 bu.	1.15	77.10
c. 28 bu.	1.50	43.00
d. 13 bu.	1.75	22.75
e. 123 lbs.	.16	19.68
f. 435 lbs.	.27	116.35
g. 513 lbs.	.11	55.43
h. 249 lbs.	.06	14.94
i. 587 lbs.	.05	29.35
j. 389 lbs.	.10	37.80

10

a. 115 lbs.	\$.11	\$ 12.65
b. 375 lbs.	.08	40.00
c. 237 doz.	.68	151.16
d. 451 gal.	.29	130.79
e. 151 bu.	1.05	158.55
f. 138 doz.	.15	30.70
g. 561 doz.	.17	96.27
h. 135 lbs.	.21	28.35
i. 650 doz.	.20	130.00
j. 548 lbs.	.19	104.12

EXERCISE No. 27, MAKING CHANGE

Making change in a cash sale involves both multiplication and subtraction by addition as explained in Exercise No. 14. Multiplication is necessary to ascertain the amount of the sale; and subtraction, to ascertain the amount of money due the customer, unless the amount rendered in payment is the exact amount of the purchase. The process is illustrated below.

You purchase eight pounds of breakfast bacon at 32c a pound and give the clerk three one-dollar bills in payment. The amount of the sale, as indicated by correct multiplication, is \$2.56. The clerk accepts the \$3; places

it in the cash register; and removes therefrom four pennies, one nickel, one dime, and one quarter; and hands them to you, counting, "256, 257, 258, 259, 260, 265, 275, \$3." He arrives at the amount to be taken out of the cash register by the same mental process. In other words, instead of subtracting \$2.56 from \$3 and returning to you 44c in change, he arrives at the amount due you by counting from the amount of the sale.

When the proper change is available, it is customary to make it with the least number of pieces. This plan was followed in the foregoing illustration. If the merchant did not have sufficient change to make it in this manner, he might give you two nickels in place of the dime, or four dimes instead of the nickel, dime, and quarter. In either case he would count the coins as he gave them to you. Thus, if he gave you four pennies and four dimes, he would say, "256, 257, 258, 259, 260, 270, 280, 290, \$3."

The following problems provide practice in ascertaining the amount of a sale and making change:

1. 3 boxes of linen note paper at 50c;
paid for with a \$2 bill.
2. 5 Eversharp pencils at 50c;
paid for with three \$1 bills.
3. 1 Icy-hot bottle for \$2.19;
paid for with a \$5 bill. No quarters are available.
4. 5 lbs. of hard candy at 59c;
paid for with a \$5 bill.
5. 8 lbs. of stuffed dates at 59c;
paid for with a \$20 bill.
6. 1 five-lb. box of Johnson's chocolates, \$3.75;
paid for with a \$10 bill.
7. 1 rubber-set brush at 98c;
paid for with a \$2 bill.
8. 2 military brushes at \$3.78;
paid for with a \$10 bill.
9. 1 shaving mirror at 69c;
paid for with a \$1 bill.
10. 6 men's handkerchiefs at 11c;
paid for with a quarter and a half dollar.

UNIT 4

DIVISION

CHAPTER 12

PRINCIPLES AND DRILLS

Division is the process of finding how many times one number is contained in another number. The number to be divided is the *dividend*; the number by which it is divided is the *divisor*; the number of times the divisor is contained in the dividend is the *quotient*; and if the divisor is not contained an exact number of times in the dividend, the number left over is the *remainder*.

The process of division, when applied to business problems, is usually indicated by the nature of the problems, and not by the usual sign of division, ($\div$).

EXERCISE No. 28, SHORT DIVISION

Division may be by one of two methods: (a) short division or (b) long division. The short division process of dividing 84,276 by 12 is illustrated below at the left, and the process of dividing 69,782 by 15 is illustrated at the right. In the one process there is no remainder, and in the other there is a remainder.

$\begin{array}{r} 12 \overline{)84276} \\ \underline{7023} \end{array}$	In the illustration at the left, you will observe that 12 is contained in 84, 7 times; is not contained in 2; but is contained in 27, 2 times	$\begin{array}{r} 15 \overline{)69782} \\ \underline{4652-2R} \end{array}$
---	--	--

with a remainder of 3, and in 36, 3 times with no remainder. The quotient can be proved by multiplying 7,023 by 12; the product should be the dividend.

In the illustration at the right, 15 is contained in 69, 4 times with a remainder of 9; in 97, 6 times with a remainder of 7; in 78, 5 times with a remainder of 3; and in 32, 2 times with a remainder of 2. This remainder is indicated by the letter *R*. The quotient can be proved by multiplying 4,652 by 15 and adding the 2; the sum of the product and the remainder should be the dividend.

The following problems provide practice in short division and illustrate the divisibility of numbers.

1
a. $3,486 \div 2$
b. $1,278 \div 2$
c. $9,832 \div 2$
d. $4,782 \div 3$
e. $2,346 \div 3$
f. $6,846 \div 3$

4
a. $3,819 \div 8$
b. $4,653 \div 8$
c. $2,781 \div 8$
d. $4,689 \div 9$
e. $3,798 \div 9$
f. $8,392 \div 9$

2
a. $3,264 \div 4$
b. $9,244 \div 4$
c. $1,484 \div 4$
d. $3,405 \div 5$
e. $3,290 \div 5$
f. $6,380 \div 5$

5
a. $4,653 \div 11$
b. $5,786 \div 11$
c. $5,748 \div 11$
d. $2,784 \div 13$
e. $6,344 \div 13$
f. $8,151 \div 13$

3
a. $7,626 \div 6$
b. $4,837 \div 6$
c. $8,634 \div 6$
d. $4,837 \div 7$
e. $8,323 \div 7$
f. $5,734 \div 7$

6
a. $3,262 \div 14$
b. $4,637 \div 14$
c. $5,642 \div 14$
d. $5,735 \div 15$
e. $1,905 \div 15$
f. $7,290 \div 15$

EXERCISE No. 29, LONG DIVISION

The process of long division requires the application of multiplication and subtraction, as indicated in the following illustrations. In short division these processes are required, but are performed mentally. The illustration given below at the left shows the long division process of dividing 9,085 by 79; and the illustration at the right, the long division process of dividing 17,334 by 84.

$$\begin{array}{r} 115 \\ 79 \overline{) 79) 9085} \\ \underline{79} \\ 118 \\ \underline{79} \\ 395 \\ \underline{395} \\ 0 \end{array}$$

The illustration at the left shows the process of long division when there is no remainder; and the one at the right, when there is a remainder. The divisor is written at the left of the dividend; and the quotient, on a line above the dividend.

When there is a remainder, it is written at the right of the quotient, as in the illustration at the right.

$$\begin{array}{r} 206-30R \\ 84 \overline{) 17334} \\ \underline{168} \\ 534 \\ \underline{504} \\ 30 \end{array}$$

The following problems provide practice in long division.

1	2	3	4
<i>a.</i> $1,568 \div 84$	<i>a.</i> $4,268 \div 49$	<i>a.</i> $8,165 \div 71$	<i>a.</i> $844,806 \div 196$
<i>b.</i> $3,978 \div 17$	<i>b.</i> $4,275 \div 25$	<i>b.</i> $8,125 \div 23$	<i>b.</i> $527,843 \div 829$
<i>c.</i> $7,280 \div 35$	<i>c.</i> $3,384 \div 62$	<i>c.</i> $7,776 \div 98$	<i>c.</i> $115,972 \div 158$
<i>d.</i> $7,668 \div 42$	<i>d.</i> $4,368 \div 28$	<i>d.</i> $5,460 \div 16$	<i>d.</i> $961,053 \div 258$
<i>e.</i> $4,784 \div 26$	<i>e.</i> $1,586 \div 26$	<i>e.</i> $3,625 \div 25$	<i>e.</i> $135,280 \div 356$
<i>f.</i> $6,120 \div 45$	<i>f.</i> $4,608 \div 36$	<i>f.</i> $8,658 \div 37$	<i>f.</i> $126,624 \div 487$

EXERCISE No. 30, PROOF OF DIVISION

The quotient in a division problem may be proved by multiplication. To prove the result when there is a remainder, it is necessary to add the remainder to the product of the quotient multiplied by the divisor.

The following problems provide practice in division and the proof of division. In each problem, divide; then prove the division by multiplication, and if there is a remainder, by addition.

1	2	3	4
a. $4,268 \div 39$	a. $685,525 \div 425$	a. $473,827 \div 921$	a. $622,080 \div 324$
b. $4,275 \div 25$	b. $738,472 \div 147$	b. $684,990 \div 129$	b. $573,841 \div 425$
c. $3,384 \div 12$	c. $362,746 \div 323$	c. $473,823 \div 352$	c. $473,821 \div 378$
d. $4,637 \div 14$	d. $263,120 \div 236$	d. $948,371 \div 237$	d. $948,573 \div 467$

EXERCISE No. 31, DIVISION BY SUBTRACTION

One number may be divided by another by subtracting the divisor from the dividend. Continue the subtraction until the remainder is less than the subtrahend. The number of times it is necessary to subtract is the quotient.

400	The illustration at the left shows the process of division by subtraction when the problem is $400 \div 129$. You will observe that it is necessary to subtract three times and that after the third subtraction there is a remainder of 13. This illustrates the fact that division is a short-cut method of subtraction. Division by subtraction is the process used by calculating machines.
129	
271	
129	
142	
129	
13	

The following problems provide practice in division by subtraction. In each case show the subtraction arranged as in the illustration, and prove by long division.

1	2	3	4
a. $702 \div 56$	a. $2,768 \div 346$	a. $11,830 \div 2,346$	a. $143,764 \div 47,856$
b. $675 \div 45$	b. $5,124 \div 854$	b. $54,391 \div 6,785$	b. $182,275 \div 36,455$
c. $653 \div 36$	c. $5,791 \div 643$	c. $23,432 \div 5,783$	c. $111,544 \div 27,886$
d. $450 \div 75$	d. $2,315 \div 385$	d. $24,988 \div 3,568$	d. $350,592 \div 58,432$

EXERCISE No. 32, MULTIPLICATION BY DIVISION

Division may be used to advantage in multiplication when two, four, or eight times either the multiplier or the multiplicand equals 1,000 or a multiple of 1,000. The illustration given below shows

the application of this method to ascertain the value of 125 bushels of wheat at \$1.14 a bushel.

\$1.14	The value of 125 bushels of wheat at \$1.14 is \$142.50. This is ascertained by multiplication, as shown at the left, or by multiplication and division, as shown at the right.	$1000 \div 125 = 8$
125		\$1.14
570		1000
228		8)1140.00
114	125 is contained in 1,000 eight times; hence, \$1.14 multiplied by 1,000 and divided by 8 gives the same result as \$1.14 multiplied by 125.	\$142.50
\$142.50		

The following problems provide practice in multiplication by division.

- | 1 | 2 |
|-------------------------|-------------------------|
| a. 17,648 bu. @ \$1.25 | a. 798 bu. @ \$5.00 |
| b. 464 bu. @ \$2.50 | b. 12,464 bu. @ \$1.25 |
| c. 1,250 lbs. @ 96c | c. 2,500 lbs. @ 75c |
| d. 1,464 bu. @ \$1.25 | d. 4,866 yds. @ \$1.25 |
| e. 500 lbs. @ \$1.45 | e. 892 yds. @ \$1.25 |
| f. 564 yds. @ \$12.50 | f. 4,132 lbs. @ \$2.50 |
| g. 2,500 yds. @ 14c | g. 654 bu. @ \$1.25 |
| h. 64,486 lbs. @ \$1.25 | h. 2,500 lbs. @ 57c |
| i. 67,384 lbs. @ \$2.50 | i. 1,250 yds. @ \$1.25 |
| j. 452 bu. @ \$1.25 | j. 4,236 bu. @ \$1.25 |
| k. 287 yds. @ \$1.25 | k. 2,066 lbs. @ \$2.50 |
| l. 1,308 bu. @ \$2.50 | l. 32,243 lbs. @ \$1.25 |
| m. 8,824 bu. @ \$5.00 | m. 1,028 yds. @ \$1.25 |
| n. 125 yds. @ 28c | n. 928 bu. @ \$2.50 |
| o. 33,692 lbs. @ \$1.25 | o. 1,308 bu. @ \$1.25 |

EXERCISE No. 33, AVERAGES

An average is obtained by dividing the sum of two or more items by the number of items added. Thus, if the average sales made by a salesman during a week are to be ascertained, the sales for the six days will be added, and the sum will be divided by six. The quotient will be the average sales. If the average number of hours worked by forty employees during a given period is to be ascertained, divide the total number of hours all the employees worked, by forty.

Mon.	\$156.50
Tues.	218.75
Wed.	74.65
Thurs.	128.80
Fri.	185.90
Sat.	91.60
6)	\$856.20
	\$142.70

The illustration at the left shows the method of ascertaining the average sales made by James Kirk, a salesman, during a given week. Adding the daily sales and dividing by 6 gives \$142.70, his average daily sales. The daily sales may be compared with the average by subtracting the daily sales from the average or the average from the daily sales. Thus, since the average is \$142.70 and the sales on Monday were \$156.50, the sales for this day are \$13.80 above the average. On Wednesday the sales were only \$74.65, so the sales for this day are \$68.05 below the average.

The following problems provide practice in determining averages and in making comparisons.

1. Monday morning, Robert Dixon and family started on an automobile trip. The speedometer registered 9,674 miles before they started. Monday night it registered 9,948 miles; Tuesday night, 10,207 miles; Wednesday night, 10,512 miles; Thursday night, 10,804 miles; Friday night, 11,078 miles; and Saturday night, 11,396 miles. Mr. Dixon wishes to know: (a) the number of miles traveled each day; and (b) the average number of miles traveled in a day.

2. The monthly sales for the Central Drug Company for the year were as follows: January, \$2,345.02; February, \$3,247.02; March, \$2,749.54; April, \$2,957.40; May, \$4,123.95; June, \$3,574.21; July, \$2,450.73; August, \$3,927.45; September, \$3,547.20; October, \$3,354.10; November, \$3,752.30; December, \$2,947.56. You are to find the average monthly sales.

3. A class of sixteen students in arithmetic took a test and made the following grades: 86; 95; 73; 92; 89; 85; 82; 78; 86; 92; 98; 84; 72; 69; 78; 85. What was the average grade of the class?

4. J. A. Ross, an author, received a royalty from his publishers during a period of six years. The first year the royalty was \$786.45; the second year, \$806.48; the third year, \$882.25; the fourth year, \$986.65; the fifth year, \$1,035.68; and the sixth year, \$1,129.41. You are to ascertain: (a) the total royalty received by Mr. Ross in the six years and (b) the average yearly royalty.

5. The circulation of an afternoon paper in a certain city during one week was as follows: Monday, 11,462 copies; Tuesday,

10,987; Wednesday, 12,455; Thursday, 11,009; Friday, 9,087; and Saturday, 16,214. You are required to show: (a) the average daily circulation; and (b) a comparison of the circulation for each day with the average. Mark the amounts which are below the average by a minus sign, and the amounts which are above the average by a plus sign.

6. Department A of the Brown Manufacturing Company had twelve employees. During one week the time worked by all the employees was as follows: Monday, 103 hours; Tuesday, 102 hours; Wednesday, 97 hours; Thursday, 94 hours; Friday, 101 hours; and Saturday, 67 hours. You are (a) to ascertain the average number of hours worked and (b) to compare the time of the following employees with this average: No. 1, 51 hours; No. 2, 48 hours; No. 3, 40 hours; and No. 4, 44 hours.

NOTE: The management is interested in each employee working the maximum number of hours, because the expense of maintaining space, heat, light, etc., for each employee goes on just the same whether he works or not. An employee who cannot work approximately the average time should be replaced by one who can do so.

7. The weight of each player on two college football teams was as follows:

Eastern College: 178 lbs., 162 lbs., 159 lbs., 154 lbs., 146 lbs., 137 lbs., 149 lbs., 156 lbs., 148 lbs., 144 lbs., 139 lbs.

Western College: 158 lbs., 152 lbs., 148 lbs., 141 lbs., 142 lbs., 140 lbs., 134 lbs., 136 lbs., 137 lbs., 133 lbs., 174 lbs.

Find (a) the total weight of each team, (b) the average weight of each team, and (c) the difference between the average weights of the teams.

8. According to the bookkeeping records, the cost of operating the business of J. L. Holland during a certain year was as follows: January, \$854.25; February, \$783.55; March, \$825.47; April, \$906.78; May, \$867.66; June, \$798.83; July, \$678.42; August, \$754.45; September, \$834.67; October, \$805.26; November, \$756.55; December, \$782.47. Mr. Holland wishes to know (a) the average monthly expenses, and (b) the comparison of each month with this average. In the comparison indicate the increase or the decrease by a plus or a minus sign.

EXERCISE No. 34, DISTRIBUTION OF OVERHEAD EXPENSE

A manufacturer must know the cost of the product made in his factory in order to fix a selling price which will provide sufficient profit to justify the operation of the factory. There are three principal elements in the cost: (a) raw material; (b) labor; and (c) overhead, or manufacturing expense. *Raw material* refers to the articles needed in the manufacture of the product; *labor* refers to the wages paid to the employees to operate the machines or do hand work; *overhead* includes the superintendent's salary, the foreman's salary, rent, heat, light, and other expenses which are a part of the direct manufacturing cost.

The following problems provide practice in distributing monthly overhead. No. 1 requires the distribution of the rent in accordance with the number of square feet in each department, as given in the five columns at the right. No. 2 requires the distribution of the superintendent's salary on a basis of the number of hours of production in each department. No. 3 requires the distribution of the cost of lighting on a basis of the number of lamps in each department. No. 4 requires the distribution of the power used for the machines on a basis of the horse power used in each department. No. 5 requires the distribution of the towel cost on a basis of the number of employees.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
1. Rent, \$500.00. Square feet.	1,650	1,040	950	960	400
2. Salary, \$300.00. Prod. hours.	1,450	1,590	1,620	950	390
3. Light, \$ 88.00. Lamps.	29	27	21	16	17
4. Power, \$490.56. Horse power	262	256	250	240	160
5. Towels, \$ 12.80. Employees..	30	25	25	22	26

NOTE: To distribute the \$500 rent, ascertain the total number of square feet by adding the number of square feet in each department; divide this into the amount paid for rent to ascertain the cost a square foot; and multiply the number of square feet in each department by the rate a square foot.

CHAPTER 13

FACTORS, MULTIPLES, AND CANCELLATION

EXERCISE No. 35, FACTORS

An *integer* is a whole number such as 1, 4, or 11. A *prime number* is one that is divisible only by 1 and itself, as 7, 11, 13, 37, etc. A *composite number* is one that is divisible by other numbers in addition to 1 and itself, as 4, 18, 48, etc. A *factor* of a number is a divisor of that number. A *prime factor* is a factor which is a prime number. An integer that is divisible by 2 is an *even number*; all other integers are *odd numbers*.

When a number is to be separated into its factors, it is necessary to divide by the factors. The following facts regarding the divisibility of numbers will be of assistance in factoring: (a) 2 is contained in all even numbers; (b) 3 is contained in a number if the sum of the digits is divisible by 3; (c) 4 is contained in a number if the number expressed by the two right-hand digits is divisible by 4; (d) 5 is contained in any number ending with 0 or 5; (e) 6 is contained in any number that is divisible by both 2 and 3; (f) 8 is contained in a number if the number expressed by the three right-hand digits is divisible by 8; (g) 9 is contained in a number if the sum of the digits is divisible by 9.

$$\begin{array}{r}
 2 \overline{)1716} \\
 2 \overline{)858} \\
 3 \overline{)429} \\
 11 \overline{)143} \\
 \hline
 13
 \end{array}$$

The illustration at the left shows the process of separating 1,716 into its prime factors. You will observe that to do this it is necessary to divide by a prime factor and to continue dividing by a prime factor until the last quotient is a prime number. Completing the division, you ascertain the prime factors of 1,716, which are 2, 2, 3, 11, 13.

The following problems provide practice in factoring and in applying the divisibility of numbers. You are to show the prime factors of each number, arranging your work in the same order as in the illustration.

1	2	3	4	5
a. 2,048	a. 68,544	a. 73,260	a. 378,000	a. 874,874
b. 6,561	b. 38,625	b. 27,930	b. 599,676	b. 356,250
c. 9,375	c. 28,980	c. 30,030	c. 498,498	c. 273,564
d. 6,930	d. 25,344	d. 26,100	d. 470,475	d. 327,978

A factor or divisor common to two or more integers is called a *common factor* or *divisor*. The greatest common divisor (g. c. d.) is the largest factor that is common to two or more given numbers; thus, 8 is the greatest common divisor of 16, 24, and 32, because it is the largest number that will exactly divide all the numbers.

EXERCISE No. 36, MULTIPLES

A *multiple* of a number is the product of that number multiplied by an integer. A *common multiple* of two or more numbers is a number that is a multiple of each. The *least common multiple* (l. c. m.) of two or more numbers is the least number that is a multiple of each.

22 is a multiple of 11, because 11, one integer, multiplied by 2, another integer, equals 22. 16 is a common multiple of 8 and 4, because either of these integers multiplied by some other integer will equal 16. 30 is the least common multiple of 5, 6, 10, 15, because any of these integers multiplied by some other integer will equal 30, and 30 is the least number which will contain each of them without a remainder.

When the least common multiple of two or more numbers is to be ascertained, it is necessary to separate each number into its prime factors and to ascertain the product of the factors.

$$\begin{aligned} 16 &= 2 \times 2 \times 2 \times 2 \\ 30 &= 2 \times 3 \times 5 \\ 32 &= 2 \times 2 \times 2 \times 2 \times 2 \\ 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 5 &= \\ 480, \text{ the l. c. m.} \end{aligned}$$

The illustration at the left shows one of the processes of finding the least common multiple of 16, 30, and 32. Each number is first separated into its prime factors. The product of these factors is then found by using each factor the greatest number of times it occurs

in any one of the given numbers.

The illustration at the right shows another method of securing the least common multiple of 16, 30, and 32. The numbers are divided by any prime number that will exactly divide two or more of them. 16, 30, and 32 are divisible by 2. 15 is not divisible by 2, so this number is brought down. The least common multiple is the product of all the divisors and the last quotient.

$$\begin{array}{r} 2) 16-30-32 \\ \hline 2) 8-15-16 \\ \hline 2) 4-15-8 \\ \hline 2) 2-15-4 \\ \hline 1-15-2 \\ 2 \times 2 \times 2 \times 2 \times 15 \times 2 = \\ 480, \text{ the l. c. m.} \end{array}$$

The following problems provide practice in finding the l. c. m. of a series of numbers.

1	2	3
a. 12, 15, 18	a. 12, 25, 27, 32	a. 14, 28, 21, 49
b. 16, 24, 28	b. 14, 81, 35, 15	b. 16, 32, 48, 28
c. 25, 28, 30	c. 24, 36, 60, 48	c. 32, 48, 35, 70
d. 36, 42, 48	d. 36, 75, 48, 24	d. 40, 30, 65, 48

EXERCISE No. 37, CANCELLATION

Cancellation refers to the elimination of factors in the dividend and the divisor before dividing. The quotient is not affected by the elimination of factors which are common to both dividend and divisor. The illustrations given below show the solution of $4,752 \div 132$ with and without cancellation.

$$\begin{array}{r}
 36 \\
 132 \overline{) 4752} \\
 \underline{396} \\
 792 \\
 \underline{792} \\
 0
 \end{array}$$

The solution at the left shows long division without cancellation. The process is the same as that used in previous exercises in long division.

The solution at the right shows

(a) the dividend factored, (b) the divisor factored, and (c) the division by cancellation. It is not necessary to separate the numbers into their prime factors; hence, the divisibility of numbers, explained in a previous exercise, may be applied. After the factor-

$$(a) 4752 = 4 \times 4 \times 9 \times 3 \times 11$$

$$(b) 132 = 4 \times 3 \times 11$$

$$(c) \frac{\cancel{4} \times 4 \times 9 \times \cancel{3} \times \cancel{11}}{\cancel{4} \times \cancel{3} \times \cancel{11}} = 36$$

ing is completed, the factors of the dividend are written above the line, and the factors of the divisor, below the line. Since 4, 3, and 11 occur both above and below the line, these may be cancelled. 4×9 is 36, the same as the answer obtained by long division.

The following problems provide practice in division by cancellation. Prove the problems in No. 1 by long division and the problems in No. 2 by multiplication.

1	2
a. $49,248 \div 2,736$	a. $(8 \times 8 \times 907) \div (2 \times 2 \times 907) =$
b. $38,100 \div 2,540$	b. $(7 \times 7 \times 7 \times 7 \times 7 \times 4) \div (7 \times 7 \times 7 \times 7 \times 2) =$
c. $58,368 \div 3,648$	c. $(6 \times 6 \times 4 \times 4 \times 4 \times 19) \div (6 \times 6 \times 4 \times 19) =$
d. $38,486 \div 2,749$	d. $(7 \times 8 \times 4 \times 3 \times 37) \div (7 \times 4 \times 3 \times 37) =$
e. $76,125 \div 3,045$	e. $(5 \times 6 \times 6 \times 8 \times 24) \div (6 \times 5 \times 3 \times 8) =$
f. $52,800 \div 3,520$	f. $(4 \times 3 \times 8 \times 32) \div (2 \times 2 \times 16 \times 3) =$
g. $36,864 \div 1,152$	g. $(81 \times 16 \times 10 \times 12) \div (9 \times 27 \times 2 \times 5) =$
h. $32,768 \div 2,048$	h. $(31 \times 28 \times 19 \times 80) \div (7 \times 19 \times 2 \times 10) =$
i. $38,367 \div 1,827$	i. $(63 \times 49 \times 21 \times 13) \div (3 \times 7 \times 9 \times 7) =$
j. $90,384 \div 3,228$	j. $(42 \times 36 \times 88 \times 22) \div (11 \times 6 \times 22 \times 21) =$

CHAPTER 14

PRACTICAL PROBLEMS

1. Robert Fisher sold his home for \$11,764; his store for \$16,145; his stock at the inventory price of \$26,381; and received \$20,000 as first payment. For the remainder he received farm land valued at \$45 an acre. How many acres did he receive?

2. A truck loaded with coal weighed 14,025 pounds. The truck weighed 4,985 pounds when it was empty. At 80 pounds a bushel, how many bushels of coal did it contain?

3. The daily sales of a high school cafeteria for the week ending March 17 were as follows: Monday, \$92.65; Tuesday, \$91.87; Wednesday, \$93.44; Thursday, \$95.14; Friday, \$89.50. What were the average sales for the five days?

4. An automobile which cost \$1,260 was traded in at the end of three years for a new automobile, and the owner was allowed \$510 for it. What was (a) the total cost caused by the decrease in the value of the car during the three years, (b) the cost for each year caused by the decrease in the value of the car?

5. The Busy Bee Department Store has four departments with space as follows: Department A, 1,250 square feet; Department B, 1,800 square feet; Department C, 3,750 feet; and Department D, 2,200 square feet. What is the monthly departmental charge for the rent of \$720 a month?

6. The report of a restaurant for one day is given below. Find the average price spent for a meal.

12 meals at 20c	18 meals at 25c	24 meals at 30c
25 meals at 35c	56 meals at 40c	55 meals at 45c
10 meals at 50c	14 meals at 55c	13 meals at 65c
12 meals at 70c	10 meals at 80c	9 meals at 95c

7. That portion of Main Street on which A. Y. Burroughs' house faces has been made an improvement district and is to be repaved. The cost of paving the 100 feet in front of Mr. Burroughs' house is \$2,761.50. The amount of Mr. Burroughs' share is one-half of that to be paid by the city. He is to have the option

of paying his share in five equal installments. What is (a) his total share and (b) the amount of each installment?

8. J. B. Reed reported the following facts regarding an automobile trip: miles on speedometer at the beginning of the trip, 21,121; miles on speedometer at the end of the trip, 29,507; number of gallons of gasoline in tank at the beginning of the trip, 18; number of gallons of gasoline purchased, 592; number of gallons of gasoline in tank at the conclusion of the trip, 11. Find: (a) the total number of miles traveled, (b) the number of gallons of gasoline used, and (c) the average number of miles a gallon.

9. The total advertising cost of the Ideal Store for the month of August was \$7,500. Distribute this on a \$100-unit basis over five departments of the store in accordance with the sales in each department, which are as follows: Department No. 1, \$12,408.53; Department No. 2, \$14,923.25; Department No. 3, \$14,001.54; Department No. 4, \$16,045.30; Department No. 5, \$17,689.50.

10. A. L. Downing has a lot 250 feet long and 120 feet wide. William Dale contracts to dig a ditch 2 feet wide and 3 feet deep around the lot, the outer edge of the ditch being 1 foot inside the division line of the lot. The contract price is 3c a cubic foot. How much will Mr. Dale receive for his work?

11. Samuel May paid \$60 for four automobile tires. The speedometer reading when the tires were put on was 8,641 miles, and when they were replaced with new ones, 23,641. What was the tire cost for each hundred miles?

12. What is the average weight a bushel of the following: 2 bu. potatoes (60 pounds); 3 bu. timothy seed, (45 pounds); 6 bu. wheat (60 pounds); 6 bu. oats (32 pounds); 3 bu. corn (56 pounds).

NOTE: The weight given in parenthesis is the weight of a bushel.

13. J. O. McKinsey leased an apartment on July 1 for three years from the following October 1, at a rental of \$3,000 a year. Mr. McKinsey was to occupy the apartment immediately, but was not to pay rent until October 1, at which time he was to pay the October rent. The rent was to be paid on the first of each month thereafter. What was the average monthly rental?

14. The cash receipts of the Stanley Department Store for the first week in March were: Monday, \$883.40; Tuesday, \$986.52; Wednesday, \$1,087.63; Thursday, \$988.43; Friday, \$1,046.25; and Saturday, \$742.51. What were the average daily sales?

CHAPTER 15

BUSINESS PRACTICE

EXERCISE No. 38, BILLING

The nature of the product and the method of packing often require division, as well as multiplication and addition, in making the extensions on an invoice. Grain is usually shipped in sacks and priced by the bushel or the hundred pounds; hay, in bales and priced by the ton; coal, in cars or trucks and priced by the ton; lumber is cut in standard lengths and priced by the thousand board feet. In billing grain, it is customary to state the quantity in pounds and the price of a bushel; hay, the quantity in pounds and the price of a ton; and lumber, the quantity in board feet and the price of a thousand board feet.

The illustrations given below show two processes of ascertaining the value of 2,240 pounds of corn at 87c a bushel of 56 pounds.

40	In the illustration at	2240	\$34.80
56)2240	the left, the quantity is	.87	56)1948.80
224	divided by the number	15680	168
	of pounds in a bushel,	17920	268
\$.87	and the price is multi-	1948.80	224
40	plied by the quotient.		448
\$34.80	In the illustration at		448
	the right, the number of		

pounds is multiplied by the price of a bushel, and the product is divided by the number of pounds in a bushel. The quotient is \$34.80 because the price of a bushel is 87c.

The following problems provide practice in making extensions and ascertaining the total of an invoice. When the price is that of a bushel or a ton and the quantity is stated in pounds, you are to show both processes given in the illustrations, one as the method of solution and the other as the proof.

1. The Central Grain Exchange sold W. S. Fedders:

100 sacks (11,480 lbs.) No. 1 corn	97c
100 sacks (11,424 lbs.) No. 2 corn	93c
100 sacks (6,624 lbs.) oats	57c

NOTE: The price of corn is that of a bushel of 56 pounds, and the price of oats is that of a bushel of 32 pounds.

2. The Shelley Grain Company sold the Jameson Grain Company:

50 sacks (5,824 lbs.) No. 1 corn	95c
50 sacks (5,936 lbs.) No. 2 corn	93c
50 sacks (3,296 lbs.) oats	57c

3. The Martin Feed Company sold L. J. DeVine:

25 bales (1,975 lbs.) No. 1 hay	\$22.75
25 sacks (2,968 lbs.) No. 1 corn	.95
25 sacks (2,856 lbs.) No. 2 corn	.93

NOTE: The price of hay is quoted for a ton of 2,000 pounds. Multiply the price by the number of pounds; point off three places to indicate division by 1,000; then divide by 2. $22.75 \times 1,975 = 44,931.25$; $44,931.25 \div 1,000 = 44.93$; $44.93 \div 2 = 22.47$.

4. The Martin Feed Company sold T. L. Dicken:

50 bales (4,827 lbs.) No. 1 hay	\$22.25
40 sacks (4,480 lbs.) No. 1 corn	.97
20 sacks (2,408 lbs.) No. 2 corn	.91
25 sacks (1,728 lbs.) oats	.53

5. The Martin Feed Company sold C. H. Madison:

100 bales (9,427 lbs.) hay	\$22.25
100 sacks (3,296 lbs.) oats	.55

6. The Central Coal Company sold J. L. Daly:

1 load (2,265 lbs.) lump coal	\$7.45
1 load (2,487 lbs.) nut coal	7.15

The price of coal is that of a ton of 2,000 pounds.

UNIT 5

COMMON FRACTIONS

CHAPTER 16

PRINCIPLES AND DRILLS

When a value which is less than a unit is to be expressed, it is necessary to show the number of equal parts into which the unit is divided and the number of these parts that are expressed. Thus, if a unit is divided into four equal parts, the value of three of these equal parts may be expressed as three-fourths.

There are two methods of indicating a fractional value with figures. When the number of equal parts into which the unit is divided is written below a line, and the number of parts expressed are written above the line, the expression is known as a *common fraction*; another expression known as a decimal fraction is discussed in a subsequent chapter. The *denominator* of a common fraction is the number which indicates the equal number of parts into which the unit is divided, and the *numerator* is the number which indicates the number of parts expressed. The numerator of a fraction is written above a horizontal line or at the left of an oblique line, and the denominator is written below the horizontal line or at the right of the oblique line. Thus, if it is desired to express the fraction *three-fourths*, it is written $\frac{3}{4}$ or $\frac{3}{4}$; 3 is the numerator, and 4 is the denominator.

When the denominator is larger than the numerator, the fraction is a *proper fraction*; when the numerator is equal to or greater than the denominator, the fraction is an *improper fraction*. Thus, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{9}{10}$, and $\frac{7}{11}$ are proper fractions, and $\frac{5}{4}$, $\frac{9}{4}$, $\frac{11}{7}$, and $\frac{11}{5}$ are improper fractions. The value of a proper fraction is *less* than a unit; the value of an improper fraction is equal to or *more* than a unit.

EXERCISE No. 39, WRITING FRACTIONS

The following problems provide oral practice in: (a) explaining the method of writing a fraction, and (b) stating whether it

is a proper or an improper fraction. You are to describe the method of writing the fraction and to state the reason for its being a proper or an improper fraction.

1	2	3
a. three-fourths	a. nine-sevenths	a. sixteen-nineteenths
b. nine-eighths	b. six-sevenths	b. fifteen-fourteenths
c. seven-sixths	c. eleven-fourteenths	c. six-seventeenths
d. five-sixths	d. twenty-fifths	d. fifteen-twelfths
e. three-thirds	e. nineteen-twentieths	e. ten-tenths

EXERCISE No. 40, REDUCTION OF FRACTIONS

The numbers used to express a fraction are referred to as its *terms*. When the numerator and the denominator are prime to each other, the fraction is expressed in its lowest terms. Factors which are common to both the numerator and the denominator may be eliminated without changing the value of the fraction. Dividing both the numerator and the denominator of a fraction by the same number eliminates a factor common to both; this is referred to as reducing the fraction to *lower terms*. If the division process eliminates all the factors which are common to both the numerator and the denominator, the fraction is reduced to its *lowest terms*. Multiplying both the numerator and the denominator of a fraction by the same number changes the terms, but does not alter the value; this process is known as reducing the fraction to *higher terms*.

The fraction $\frac{5}{6}$ is expressed in its lowest terms, because 5 and 6 are prime to each other. The fraction $\frac{6}{12}$ is not expressed in its lowest terms, because 2 is a factor common to both the numerator and the denominator. Hence, to reduce $\frac{6}{12}$ to its lowest terms, it will be necessary to divide by 2. The fraction is then changed to $\frac{3}{6}$. If the fraction $\frac{5}{6}$ is to be expressed in twelfths, it is necessary to multiply both the numerator and the denominator by 2. The fraction is then changed to $\frac{10}{12}$; the value of the fraction $\frac{10}{12}$ is the same as the value of the fraction $\frac{5}{6}$.

The following problems provide oral practice in the use of fractions.

1. Reduce to lowest terms: $\frac{6}{10}$, $\frac{7}{21}$, $\frac{5}{20}$, $\frac{27}{33}$, $\frac{10}{15}$, $\frac{15}{18}$, $\frac{20}{24}$, $\frac{18}{27}$.
2. Express each of the following fractions with a denominator of 12: $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$.

3. Reduce to lowest terms: $\frac{9}{12}, \frac{14}{21}, \frac{5}{12}, \frac{6}{12}, \frac{27}{36}, \frac{12}{18}, \frac{8}{16}, \frac{9}{12}$.
4. Express each of the following with a denominator of 36:
 $\frac{1}{2}, \frac{3}{4}, \frac{2}{3}, \frac{4}{9}, \frac{5}{12}, \frac{7}{18}$.
5. Reduce to lowest terms: $\frac{18}{20}, \frac{6}{15}, \frac{5}{25}, \frac{25}{30}, \frac{13}{26}, \frac{16}{28}, \frac{5}{20}, \frac{14}{28}$.
6. Express each of the following with a denominator of 48:
 $\frac{1}{2}, \frac{2}{3}, \frac{1}{4}, \frac{5}{6}, \frac{3}{8}, \frac{11}{16}, \frac{7}{24}$.
7. Reduce to lowest terms: $\frac{24}{48}, \frac{36}{54}, \frac{17}{51}, \frac{63}{72}, \frac{27}{81}, \frac{99}{70}$.
8. $\frac{1}{2}$ = how many 4ths, 10ths, 6ths, 12ths, 8ths, 24ths, 16ths, 14ths, 20ths, 32ds, 26ths, 40ths, 72ds, 18ths, 22ds, 34ths, 30ths, 88ths, 56ths, 38ths, 76ths, 64ths?
9. $\frac{1}{3}$ = how many 9ths, 30ths, 6ths, 15ths, 21sts, 18ths, 45ths, 12ths, 27ths, 72ds, 51sts, 33ds, 42ds, 39ths, 54ths, 60ths, 36ths, 57ths, 48ths, 69ths, 75ths, 93ds?
10. $\frac{1}{4}$ = how many 8ths, 16ths, 24ths, 44ths, 12ths, 56ths, 64ths, 32ds, 40ths, 52ds, 84ths, 96ths, 76ths, 36ths, 48ths, 28ths, 60ths, 68ths, 80ths, 88ths, 92ds?
11. $\frac{1}{5}$ = how many 5ths, 30ths, 45ths, 20ths, 80ths, 65ths, 15ths, 35ths, 75ths, 90ths, 55ths, 70ths, 25ths, 50ths, 10ths, 60ths, 95ths, 125ths, 100ths, 110ths?

EXERCISE No. 41, CHANGING THE VALUE OF A FRACTION

The value of a fraction is increased: (a) by multiplying the numerator by a number greater than 1; (b) by dividing the denominator by a number greater than 1. Thus, multiplying the numerator of the fraction $\frac{3}{4}$ by 2 gives the fraction $\frac{6}{4}$; dividing the denominator of the fraction $\frac{3}{4}$ by 2 gives $\frac{3}{2}$. The value of the fraction has been doubled in each case.

The value of a fraction is decreased: (a) by dividing the numerator by a number greater than 1; (b) by multiplying the de-

numerator by a number greater than 1. Thus, dividing the numerator of the fraction $\frac{4}{5}$ by 2 gives $\frac{2}{5}$; multiplying the denominator of the fraction $\frac{4}{5}$ by 2 gives $\frac{4}{10}$. The value of the fraction has been reduced one-half in each case.

The following problems provide oral practice in increasing or decreasing the value of a fraction by the multiplication or the division of the numerator or the denominator. You are required to state in each case the value of the fraction after multiplication or division, and whether it is greater or less.

1. Divide the numerator or multiply the denominator of each of the following fractions by 3: $\frac{3}{4}$, $\frac{6}{7}$, $\frac{12}{13}$, $\frac{18}{19}$, $\frac{24}{25}$, $\frac{30}{31}$.
2. Multiply the numerator or divide the denominator of each of the following fractions by 4: $\frac{1}{4}$, $\frac{3}{8}$, $\frac{7}{12}$, $\frac{11}{16}$, $\frac{19}{20}$, $\frac{23}{24}$.
3. Divide the numerator or multiply the denominator of each of the following fractions by 6: $\frac{6}{7}$, $\frac{12}{17}$, $\frac{18}{19}$, $\frac{24}{25}$, $\frac{30}{31}$, $\frac{36}{37}$.
4. Multiply the numerator or divide the denominator of each of the following fractions by 8: $\frac{3}{8}$, $\frac{5}{16}$, $\frac{7}{24}$, $\frac{5}{32}$, $\frac{9}{40}$, $\frac{11}{48}$.

EXERCISE No. 42, MIXED NUMBERS

A mixed number is one which expresses a value in a whole number and a fraction. Thus, if the value is five and three-fourths, it is expressed in figures in the form of a mixed number as $5\frac{3}{4}$. The value of a mixed number may be represented by an improper fraction, as $\frac{23}{4}$.

The following problems provide practice in expressing the value in figures in the form of a mixed number.

1. Ninety-nine and seven-sixteenths
2. Twelve and nine-elevenths
3. Two hundred forty-five and four twenty-fifths
4. Ninety-one and three-fourths
5. Seventy-six and five-eighteenths
6. Fifty-four and four-ninths
7. Sixteen and five-eighths
8. Twenty-seven and five thirty-seconds
9. Thirty-six and four twenty-fifths
10. Forty-six and fifteen-sixteenths

EXERCISE No. 43, MIXED NUMBERS

The following problems provide practice in changing an improper fraction to a mixed number, and a mixed number to an improper fraction.

The illustrations given below show the calculations necessary to change the mixed number $37\frac{7}{8}$ to an improper fraction, and the improper fraction $\frac{683}{18}$ to a mixed number.

$ \begin{array}{r} 37\frac{7}{8} = \frac{683}{18} \\ 18 \\ \hline 296 \\ 37 \\ \hline 666 \\ 17 \\ \hline 683 \end{array} $	37 is multiplied by 18, and 17 is added to the product. The result is a fraction with the numerator, 683, and the denominator, 18. When the process is reversed, the numerator, 683, is divided by the denominator, 18. The quotient, 37, is the integer; the numerator of the fraction is 17; and the	$ \begin{array}{r} \frac{683}{18} = 683 \div 18 = 37\frac{7}{8} \\ 37\frac{7}{8} \\ 18 \overline{)683} \\ \underline{54} \\ 143 \\ \underline{126} \\ 17 \end{array} $
--	--	--

denominator is 18, which is the same denominator as that in the improper fraction.

Change to mixed numbers:

- | | | | | | |
|------------------------|---------------------|---------------------|---------------------|----------------------|----------------------|
| 1. $a. \frac{465}{16}$ | $b. \frac{647}{85}$ | $c. \frac{523}{41}$ | $d. \frac{625}{26}$ | $e. \frac{330}{43}$ | $f. \frac{448}{221}$ |
| 2. $a. \frac{234}{87}$ | $b. \frac{563}{55}$ | $c. \frac{479}{76}$ | $d. \frac{809}{87}$ | $e. \frac{688}{24}$ | $f. \frac{222}{112}$ |
| 3. $a. \frac{125}{68}$ | $b. \frac{827}{88}$ | $c. \frac{734}{71}$ | $d. \frac{426}{42}$ | $e. \frac{522}{86}$ | $f. \frac{643}{333}$ |
| 4. $a. \frac{634}{89}$ | $b. \frac{236}{28}$ | $c. \frac{128}{36}$ | $d. \frac{689}{42}$ | $e. \frac{956}{634}$ | $f. \frac{996}{122}$ |

Change to improper fractions:

- | 1 | 2 | 3 | 4 | 5 | 6 |
|--------------------|---------------------|--------------------|---------------------|-----------------------|-----------------------|
| $a. 66\frac{3}{8}$ | $a. 47\frac{2}{5}$ | $a. 88\frac{4}{5}$ | $a. 183\frac{4}{5}$ | $a. 476\frac{5}{12}$ | $a. 588\frac{15}{46}$ |
| $b. 47\frac{7}{8}$ | $b. 55\frac{4}{9}$ | $b. 91\frac{2}{3}$ | $b. 198\frac{9}{7}$ | $b. 684\frac{9}{11}$ | $b. 226\frac{9}{4}$ |
| $c. 86\frac{2}{3}$ | $c. 68\frac{3}{8}$ | $c. 72\frac{4}{7}$ | $c. 234\frac{7}{8}$ | $c. 782\frac{13}{15}$ | $c. 325\frac{23}{9}$ |
| $d. 27\frac{7}{9}$ | $d. 48\frac{3}{4}$ | $d. 89\frac{3}{5}$ | $d. 681\frac{2}{3}$ | $d. 575\frac{6}{11}$ | $d. 609\frac{4}{11}$ |
| $e. 48\frac{2}{3}$ | $e. 19\frac{1}{6}$ | $e. 16\frac{1}{8}$ | $e. 181\frac{1}{2}$ | $e. 431\frac{10}{11}$ | $e. 189\frac{1}{7}$ |
| $f. 13\frac{5}{6}$ | $f. 11\frac{5}{8}$ | $f. 17\frac{2}{3}$ | $f. 168\frac{1}{3}$ | $f. 134\frac{8}{9}$ | $f. 300\frac{1}{9}$ |
| $g. 24\frac{7}{8}$ | $g. 9\frac{10}{11}$ | $g. 81\frac{3}{8}$ | $g. 99\frac{9}{10}$ | $g. 101\frac{1}{10}$ | $g. 201\frac{1}{11}$ |

CHAPTER 17

ADDITION OF FRACTIONS

As explained in Unit 1, the purpose of addition is to ascertain the sum of two or more numbers. This same purpose applies to the addition of fractions.

Since a fraction is one or more of the equal parts of a unit, and the equal division of the units is indicated by the denominator and the value is expressed by the numerator, it is quite evident that fractions cannot be added unless the denominators are the same. When the denominators of two fractions are expressed by the same number, the process of addition is to add the numerators and to write this sum as the numerator over the same number as the denominator. Thus, $\frac{2}{6} + \frac{3}{6} = \frac{5}{6}$.

When the denominator of each of the fractions to be added is expressed by a different number, it is necessary to reduce the fractions to a common denominator. Thus, if it is desired to add $\frac{5}{6}$ and $\frac{1}{3}$, the one-third may be changed to sixths by reducing the fraction to higher terms: 3 is contained in 6 two times; the numerator of $\frac{1}{3}$ multiplied by 2 changes the fraction to $\frac{2}{6}$. Hence, the problem is: $\frac{5}{6} + \frac{2}{6} = \frac{7}{6} = 1\frac{1}{6}$.

Common fractions are used extensively in business; and in some lines such as dry goods, many problems require the addition of fractional values expressed in common fraction form. Usually in business problems, fractional values are expressed in fractions with small denominators, such as $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, and sometimes $\frac{1}{32}$.

EXERCISE No. 44, ADDITION OF FRACTIONS

The following problems provide oral practice in adding fractions with small denominators.

NOTE: The answer should be stated as a fraction if the value is less than one, or as a mixed number with the fraction in its lowest terms if the value is more than one.

1	2	3	4
$a. \frac{1}{5} + \frac{2}{5} =$	$a. \frac{2}{3} + \frac{3}{4} =$	$a. \frac{3}{5} + \frac{2}{5} + \frac{4}{5} =$	$a. \frac{1}{3} + \frac{1}{4} + \frac{1}{2} =$
$b. \frac{7}{10} + \frac{3}{10} =$	$b. \frac{3}{5} + \frac{7}{10} =$	$b. \frac{3}{7} + \frac{5}{7} + \frac{2}{7} =$	$b. \frac{4}{5} + \frac{1}{5} + \frac{3}{4} =$
$c. \frac{4}{5} + \frac{3}{5} =$	$c. \frac{4}{7} + \frac{3}{14} =$	$c. \frac{4}{9} + \frac{2}{9} + \frac{5}{9} =$	$c. \frac{2}{9} + \frac{3}{9} + \frac{1}{3} =$
$d. \frac{5}{11} + \frac{4}{11} =$	$d. \frac{5}{6} + \frac{1}{3} =$	$d. \frac{3}{10} + \frac{5}{10} + \frac{7}{10} =$	$d. \frac{3}{7} + \frac{5}{14} + \frac{2}{14} =$
$e. \frac{7}{12} + \frac{7}{12} =$	$e. \frac{4}{9} + \frac{5}{9} =$	$e. \frac{3}{14} + \frac{5}{14} + \frac{9}{14} =$	$e. \frac{7}{16} + \frac{3}{4} + \frac{3}{8} =$

EXERCISE No. 45, LEAST COMMON DENOMINATOR

When the denominators of the fractions to be added are expressed as large numbers or as large and small numbers, and it is therefore inconvenient to determine the common denominator mentally, it is necessary to obtain the common denominator of the fractions by factoring. Although any common denominator is satisfactory, it is better to secure the least common denominator, and thus to save time in reducing and adding the fractions.

The illustration given below shows a solution of the problem:

$$\frac{5}{36} + \frac{7}{24} + \frac{17}{18} = 1\frac{3}{8}.$$

$$a. \begin{array}{r} 2) 36 - 24 - 18 \\ \hline 2) 18 - 12 - 9 \\ \hline 3) 9 - 6 - 9 \\ \hline 3) 3 - 2 - 3 \\ \hline 1 - 2 - 1 \end{array}$$

$$2 \times 2 \times 3 \times 3 \times 2 = 72$$

$$l. c. m. = 72$$

$$b. \begin{array}{l} \frac{5}{36} \times \frac{2}{2} = \frac{10}{72} \\ \frac{7}{24} \times \frac{3}{3} = \frac{21}{72} \\ \frac{17}{18} \times \frac{4}{4} = \frac{68}{72} \\ \hline \frac{99}{72} = 1\frac{27}{72} = 1\frac{3}{8} \end{array}$$

In factoring to secure the least common multiple and to reduce the fractions to their least common denominator, it is necessary to divide the denominators of the fractions by prime numbers which will exactly divide two or more of them. The l. c. m., which is to be the denominator of the fractions, is obtained by multiplying together the divisors and the remainders. The next process is to find the value of each fraction in seventy-seconds. The fractions are then added. The sum is an improper fraction, which is reduced to a mixed number with the fraction in its lowest terms.

The following problems provide practice in the addition of two or more fractions. Show: (a) the factoring necessary to secure the l. c. m.; (b) the calculations necessary to reduce each fraction so that its value may be expressed in that of the l. c. m.; (c) the process of addition and reduction of the sum to a fraction or a mixed number with the fraction in its lowest terms.

1	2	3	4
a. $\frac{9}{14} + \frac{17}{28} =$	a. $\frac{11}{17} + \frac{8}{34} =$	a. $\frac{5}{28} + \frac{7}{16} + \frac{3}{14} =$	a. $\frac{5}{13} + \frac{3}{26} + \frac{7}{8} =$
b. $\frac{13}{18} + \frac{13}{20} =$	b. $\frac{5}{72} + \frac{53}{56} =$	b. $\frac{4}{15} + \frac{13}{25} + \frac{29}{30} =$	b. $\frac{3}{11} + \frac{9}{99} + \frac{7}{66} =$
c. $\frac{7}{24} + \frac{19}{36} =$	c. $\frac{31}{32} + \frac{49}{96} =$	c. $\frac{11}{12} + \frac{29}{32} + \frac{13}{16} =$	c. $\frac{13}{45} + \frac{23}{36} + \frac{13}{18} =$
d. $\frac{25}{36} + \frac{19}{48} =$	d. $\frac{43}{48} + \frac{35}{36} =$	d. $\frac{3}{30} + \frac{47}{54} + \frac{23}{27} =$	d. $\frac{25}{56} + \frac{13}{28} + \frac{7}{12} =$
e. $\frac{41}{50} + \frac{12}{25} =$	e. $\frac{19}{20} + \frac{7}{40} =$	e. $\frac{1}{10} + \frac{3}{20} + \frac{7}{30} =$	e. $\frac{4}{7} + \frac{3}{28} + \frac{9}{42} =$

EXERCISE No. 46, ADDITION OF FRACTIONS

The following problems provide practice in adding a number of fractions.

1	2	3
a. $\frac{1}{6} + \frac{2}{3} + \frac{3}{4} + \frac{1}{2} =$	a. $\frac{2}{5} + \frac{3}{10} + \frac{7}{10} + \frac{3}{5} =$	a. $\frac{5}{24} + \frac{3}{8} + \frac{5}{16} + \frac{8}{9} =$
b. $\frac{3}{5} + \frac{1}{10} + \frac{1}{2} + \frac{5}{6} =$	b. $\frac{1}{8} + \frac{3}{4} + \frac{1}{2} + \frac{7}{8} =$	b. $\frac{3}{20} + \frac{3}{5} + \frac{5}{10} + \frac{2}{15} =$
c. $\frac{2}{3} + \frac{5}{8} + \frac{7}{12} + \frac{1}{6} =$	c. $\frac{2}{3} + \frac{5}{6} + \frac{1}{2} + \frac{1}{3} =$	c. $\frac{3}{72} + \frac{9}{24} + \frac{7}{8} + \frac{5}{12} =$
d. $\frac{5}{7} + \frac{2}{3} + \frac{7}{9} + \frac{1}{3} =$	d. $\frac{1}{4} + \frac{7}{12} + \frac{2}{3} + \frac{2}{6} =$	d. $\frac{24}{80} + \frac{2}{5} + \frac{7}{16} + \frac{1}{8} =$
e. $\frac{1}{9} + \frac{3}{7} + \frac{2}{3} + \frac{6}{7} =$	e. $\frac{2}{3} + \frac{4}{9} + \frac{1}{18} + \frac{5}{6} =$	e. $\frac{32}{65} + \frac{3}{13} + \frac{4}{5} + \frac{9}{10} =$
f. $\frac{1}{6} + \frac{1}{8} + \frac{1}{3} + \frac{1}{4} =$	f. $\frac{2}{9} + \frac{3}{7} + \frac{1}{18} + \frac{1}{14} =$	f. $\frac{2}{31} + \frac{1}{62} + \frac{1}{4} + \frac{1}{12} =$

EXERCISE No. 47, ADDITION OF MIXED NUMBERS

When a problem requires the addition of mixed numbers, the process is the same as the addition of whole numbers and the addition of fractions. The illustration given below shows the process of adding $49\frac{2}{3}$ and $16\frac{2}{3}$.

$$\begin{array}{r} 49\frac{2}{3} \\ 16\frac{2}{3} \\ \hline 66\frac{1}{3} \end{array}$$

Add the fractions first: $\frac{2}{3} + \frac{2}{3} = \frac{4}{3} = 1\frac{1}{3}$. Place the $\frac{1}{3}$ and carry the 1. Add the units column of the whole numbers: $1+6+9=16$. Place the 6 and carry the 1. Add the tens column: $1+1+4=6$. Place the 6 under the tens column. The sum of the two mixed numbers is $66\frac{1}{3}$.

The following problems provide oral practice in the addition of mixed numbers.

1. $3\frac{1}{2} + 18\frac{1}{2} =$	11. $35\frac{5}{6} + 33\frac{1}{3} =$	21. $45\frac{5}{6} + 13\frac{5}{12} =$
2. $16\frac{2}{3} + 24\frac{1}{3} =$	12. $17\frac{1}{3} + 18\frac{3}{10} =$	22. $43\frac{14}{15} + 17\frac{4}{5} =$
3. $37\frac{1}{8} + 12\frac{1}{4} =$	13. $37\frac{5}{8} + 19\frac{1}{4} =$	23. $58\frac{5}{12} + 16\frac{5}{6} =$
4. $775\frac{1}{5} + 18\frac{2}{5} =$	14. $17\frac{1}{2} + 45\frac{3}{4} =$	24. $39\frac{3}{8} + 15\frac{1}{6} =$
5. $19\frac{3}{4} + 17\frac{1}{8} =$	15. $18\frac{1}{6} + 14\frac{2}{3} =$	25. $27\frac{5}{6} + 17\frac{2}{3} =$
6. $64\frac{1}{7} + 46\frac{5}{7} =$	16. $22\frac{3}{8} + 19\frac{3}{4} =$	26. $15\frac{1}{2} + 15\frac{2}{3} =$
7. $49\frac{2}{3} + 16\frac{2}{3} =$	17. $19\frac{3}{10} + 75\frac{4}{5} =$	27. $71\frac{1}{10} + 12\frac{5}{6} =$
8. $19\frac{3}{8} + 27\frac{7}{8} =$	18. $77\frac{3}{7} + 15\frac{9}{14} =$	28. $45\frac{2}{3} + 11\frac{1}{4} =$
9. $14\frac{9}{7} + 21\frac{2}{7} =$	19. $78\frac{1}{10} + 12\frac{1}{5} =$	29. $39\frac{4}{7} + 93\frac{2}{7} =$
10. $78\frac{5}{9} + 12\frac{2}{3} =$	20. $68\frac{7}{10} + 11\frac{9}{10} =$	30. $75\frac{1}{8} + 45\frac{3}{4} =$

EXERCISE No. 48, ADDITION OF MIXED NUMBERS

The following problems provide practice in the addition of mixed numbers.

- ✓ 1. $192\frac{3}{4} + 17\frac{5}{6} =$ 14. $214\frac{9}{32} + 69\frac{3}{8} =$ 27. $137\frac{5}{6} + 78\frac{6}{7} =$
2. $187\frac{1}{6} + 96\frac{2}{3} =$ 15. $163\frac{18}{31} + 724\frac{2}{3} =$ 28. $194\frac{5}{21} + 183\frac{6}{7} =$
- ✓ 3. $98\frac{3}{5} + 85\frac{3}{8} =$ 16. $147\frac{3}{10} + 127\frac{2}{7} =$ 29. $186\frac{15}{16} + 75\frac{9}{108} =$
4. $126\frac{6}{7} + 74\frac{3}{5} =$ 17. $193\frac{14}{15} + 67\frac{16}{25} =$ 30. $87\frac{3}{4} + 67\frac{7}{45} =$
- ✓ 5. $79\frac{6}{11} + 81\frac{15}{22} =$ 18. $98\frac{19}{28} + 77\frac{31}{35} =$ 31. $128\frac{1}{7} + 76\frac{11}{13} =$
6. $96\frac{1}{4} + 77\frac{9}{20} =$ 19. $714\frac{4}{9} + 69\frac{1}{2} =$ 32. $126\frac{9}{2} + 47\frac{7}{18} =$
7. $73\frac{1}{45} + 106\frac{8}{9} =$ 20. $215\frac{9}{18} + 75\frac{3}{4} =$ 33. $195\frac{8}{10} + 726\frac{5}{11} =$
8. $915\frac{6}{7} + 94\frac{1}{15} =$ 21. $89\frac{7}{8} + 45\frac{12}{15} =$ 34. $624\frac{9}{24} + 115\frac{15}{72} =$
9. $726\frac{11}{2} + 86\frac{4}{5} =$ 22. $215\frac{11}{2} + 230\frac{15}{8} =$ 35. $312\frac{3}{2} + 65\frac{13}{8} =$
10. $123\frac{7}{8} + 49\frac{9}{7} =$ 23. $318\frac{9}{10} + 64\frac{7}{8} =$ 36. $163\frac{8}{11} + 83\frac{3}{10} =$
11. $215\frac{9}{4} + 67\frac{30}{80} =$ 24. $64\frac{29}{30} + 86\frac{23}{48} =$ 37. $134\frac{24}{34} + 526\frac{45}{83} =$
12. $945\frac{35}{48} + 212\frac{3}{16} =$ 25. $86\frac{14}{25} + 76\frac{35}{45} =$ 38. $915\frac{16}{21} + 49\frac{75}{105} =$
13. $712\frac{7}{25} + 127\frac{27}{36} =$ 26. $126\frac{27}{82} + 815\frac{62}{124} =$ 39. $715\frac{65}{72} + 146\frac{7}{12} =$

CHAPTER 18

SUBTRACTION OF FRACTIONS

The subtraction of fractions involves: (a) the subtraction of one common fraction from another; (b) the subtraction of a fraction from a whole number; (c) the subtraction of a fraction from a mixed number; or (d) the subtraction of one mixed number from another. The process requires the denominators of the fractions to be the same, and one numerator to be subtracted from the other.

EXERCISE No. 49, SUBTRACTION OF COMMON FRACTIONS

The following problems provide oral practice in subtracting fractions in which the denominators are the same or the denominators are such that the least common denominator may be determined by observation. Accuracy and speed in solving problems involving fractions are just as important as in solving problems involving whole numbers.

1	2	3	4
a. $\frac{7}{8} - \frac{2}{8}$	a. $\frac{7}{9} - \frac{3}{9}$	a. $\frac{5}{6} - \frac{1}{6}$	a. $\frac{4}{5} - \frac{1}{10}$
b. $\frac{3}{4} - \frac{1}{4}$	b. $\frac{4}{7} - \frac{1}{6}$	b. $\frac{5}{8} - \frac{1}{6}$	b. $\frac{7}{9} - \frac{4}{18}$
c. $\frac{5}{6} - \frac{3}{8}$	c. $\frac{8}{9} - \frac{3}{4}$	c. $\frac{3}{4} - \frac{2}{7}$	c. $\frac{2}{3} - \frac{1}{10}$
d. $\frac{2}{3} - \frac{1}{3}$	d. $\frac{2}{5} - \frac{2}{7}$	d. $\frac{7}{8} - \frac{1}{2}$	d. $\frac{6}{7} - \frac{3}{14}$
e. $\frac{4}{9} - \frac{2}{9}$	e. $\frac{1}{2} - \frac{1}{9}$	e. $\frac{5}{6} - \frac{1}{3}$	e. $\frac{5}{6} - \frac{5}{12}$
f. $\frac{2}{3} - \frac{1}{4}$	f. $\frac{1}{3} - \frac{3}{5}$	f. $\frac{3}{4} - \frac{1}{2}$	f. $\frac{4}{5} - \frac{3}{10}$
g. $\frac{7}{12} - \frac{1}{6}$	g. $\frac{5}{6} - \frac{2}{9}$	g. $\frac{5}{8} - \frac{1}{2}$	g. $\frac{1}{2} - \frac{2}{9}$
h. $\frac{4}{15} - \frac{1}{5}$	h. $\frac{8}{15} - \frac{1}{3}$	h. $\frac{3}{4} - \frac{1}{5}$	h. $\frac{2}{3} - \frac{1}{6}$

EXERCISE No. 50, SUBTRACTION OF COMMON FRACTIONS

When the denominators are not the same, and a common denominator cannot be ascertained mentally, it is necessary to factor just as in the addition of fractions.

The following problems provide written practice in subtracting one fraction from another.

1	2	3	4
a. $\frac{11}{15} - \frac{3}{5}$	a. $\frac{25}{56} - \frac{2}{7}$	a. $\frac{14}{25} - \frac{3}{75}$	a. $\frac{14}{39} - \frac{3}{13}$
b. $\frac{10}{11} - \frac{3}{22}$	b. $\frac{23}{28} - \frac{5}{14}$	b. $\frac{27}{32} - \frac{5}{64}$	b. $\frac{13}{15} - \frac{13}{21}$
c. $\frac{11}{12} - \frac{7}{60}$	c. $\frac{37}{42} - \frac{5}{18}$	c. $\frac{8}{27} - \frac{5}{54}$	c. $\frac{17}{28} - \frac{13}{42}$
d. $\frac{22}{27} - \frac{2}{9}$	d. $\frac{7}{16} - \frac{3}{64}$	d. $\frac{9}{10} - \frac{11}{15}$	d. $\frac{21}{64} - \frac{13}{56}$
e. $\frac{13}{15} - \frac{8}{45}$	e. $\frac{16}{36} - \frac{1}{9}$	e. $\frac{17}{24} - \frac{5}{18}$	e. $\frac{18}{24} - \frac{11}{26}$
f. $\frac{27}{32} - \frac{13}{24}$	f. $\frac{49}{72} - \frac{3}{8}$	f. $\frac{7}{18} - \frac{5}{36}$	f. $\frac{32}{36} - \frac{13}{48}$

EXERCISE No. 51, A FRACTION FROM A WHOLE NUMBER

The following problems provide oral practice in subtracting a fraction from a whole number.

1	2	3	4
a. $1 - \frac{1}{2}$	a. $5 - \frac{5}{9}$	a. $7 - \frac{7}{11}$	a. $16 - \frac{2}{3}$
b. $3 - \frac{3}{4}$	b. $6 - \frac{7}{8}$	b. $8 - \frac{8}{13}$	b. $4 - \frac{3}{4}$
c. $4 - \frac{5}{8}$	c. $5 - \frac{4}{5}$	c. $16 - \frac{7}{16}$	c. $2 - \frac{2}{3}$
d. $1 - \frac{7}{8}$	d. $1 - \frac{1}{3}$	d. $18 - \frac{11}{18}$	d. $1 - \frac{9}{10}$
e. $2 - \frac{3}{7}$	e. $2 - \frac{5}{6}$	e. $12 - \frac{7}{2}$	e. $15 - \frac{4}{5}$
f. $3 - \frac{2}{3}$	f. $8 - \frac{2}{5}$	f. $15 - \frac{3}{4}$	f. $18 - \frac{1}{6}$

EXERCISE No. 52, MIXED NUMBERS

When it is desired to subtract a mixed number from a whole number or a whole number from a mixed number, the fractional value should be subtracted or carried down first, and then the whole number should be subtracted. The illustration at the left shows the process of subtracting 55 from $77\frac{4}{5}$, and the one at the right, the process of subtracting $37\frac{5}{8}$ from 88 .

In the illustration at the left, the fraction $\frac{4}{5}$ is brought down, because there is nothing to subtract from it. The whole number 55 is then subtracted in the usual way.

$22\frac{4}{5}$ In the illustration at the right, one whole number, $50\frac{11}{8}$

$\frac{11}{8}$, is borrowed from 88 in order that $\frac{5}{8}$ may be subtracted. This leaves a remainder of $\frac{1}{8}$. 88 is now 87 , because 1 has been borrowed. $87 - 37 = 50$.

The following problems provide practice in subtracting a mixed number from a whole number and a whole number from a mixed number.

1	2	3	4
a. $49 - 32\frac{3}{16}$	a. $27\frac{5}{16} - 19$	a. $39 - 27\frac{5}{16}$	a. $95\frac{1}{3} - 77$
b. $97 - 38\frac{2}{5}$	b. $92\frac{2}{5} - 63$	b. $42 - 33\frac{7}{8}$	b. $79\frac{2}{10} - 36$
c. $55 - 27\frac{1}{9}$	c. $52\frac{1}{3} - 27$	c. $86 - 57\frac{9}{43}$	c. $85\frac{4}{7} - 67$
d. $63 - 32\frac{2}{3}$	d. $49\frac{6}{11} - 41$	d. $74 - 35\frac{7}{10}$	d. $68\frac{3}{8} - 35$

EXERCISE No. 53, A MIXED NUMBER FROM A MIXED NUMBER

When a problem requires the subtraction of one mixed number from another, the process is the same as when one of the numbers involved is an integer; that is, the fraction is subtracted or carried down first, and then the whole number is subtracted.

$$\begin{array}{r}
 47\frac{7}{16} \\
 25\frac{3}{8} \\
 \hline
 22\frac{4}{16} = 22\frac{1}{4}
 \end{array}$$

The illustration at the left shows

the solution of $47\frac{7}{16} - 25\frac{3}{8}$. Since $\frac{3}{8}$ is smaller than $\frac{7}{16}$, it is not necessary to borrow.

The illustration at the right shows the solution of $37\frac{1}{8} - 21\frac{3}{4}$. Since $\frac{1}{8}$

is smaller than $\frac{3}{4}$, it is necessary to borrow 1, or $\frac{2}{2}$. The difference between the fractions is $\frac{5}{8}$. 21 subtracted from 36 leaves 15.

$$\begin{array}{r}
 37\frac{1}{8} \\
 -21\frac{3}{4} \\
 \hline
 15\frac{5}{8}
 \end{array}$$

The following problems provide practice in the subtraction of mixed numbers. Show all calculations necessary in solving these problems.

1	2	3
a. $18\frac{5}{12} - 16\frac{3}{5} =$	a. $197\frac{1}{4} - 88\frac{1}{2} =$	a. $712\frac{1}{16} - 639\frac{3}{40} =$
b. $92\frac{1}{8} - 36\frac{4}{5} =$	b. $279\frac{5}{7} - 93\frac{3}{4} =$	b. $212\frac{1}{15} - 138\frac{6}{45} =$
c. $71\frac{1}{5} - 47\frac{3}{7} =$	c. $261\frac{7}{8} - 39\frac{7}{12} =$	c. $176\frac{3}{32} - 132\frac{7}{8} =$
d. $18\frac{2}{17} - 13\frac{1}{5} =$	d. $198\frac{6}{7} - 96\frac{3}{8} =$	d. $169\frac{7}{11} - 142\frac{8}{22} =$

EXERCISE No. 54, ORAL PROBLEMS

1: A merchant bought a piece of cloth containing $30\frac{1}{2}$ yards, from which he cut two pieces of $8\frac{3}{4}$ and $12\frac{1}{2}$ yards. How many yards remained?

2. From the number 34 continue to subtract $4\frac{1}{4}$ until nothing remains.

3. You buy $14\frac{1}{2}$ yards of cloth and make two dresses from the same pattern. If you allow $\frac{1}{2}$ yard for waste and have $\frac{3}{4}$ yard left, how many yards are there in each dress?

4. Add 6 to each term of $\frac{2}{3}$ and state how much the fraction is increased or decreased.

5. Add 2 to the numerator of the fraction $\frac{3}{9}$ and subtract 3 from the denominator.

6. A clerk sold $6\frac{1}{2}$ yards of cloth from a piece containing $20\frac{1}{4}$ yards. How many yards remained?

EXERCISE No. 55, WRITTEN PROBLEMS

1. Three cases of books which weighed $359\frac{1}{2}$, $462\frac{3}{4}$, and $495\frac{1}{4}$ pounds were received. The wooden cases in which they were shipped weighed $16\frac{3}{4}$, $17\frac{1}{2}$, and $18\frac{3}{4}$ pounds. Find the gross weight, the net weight of the books, and the total weight of the cases.

2. When A. J. Brown left his city home by motor for his farm, he estimated that he had $16\frac{3}{4}$ gallons of gasoline. Another test at the farm showed that he had $12\frac{1}{2}$ gallons. He returned to the city and found he had $7\frac{1}{4}$ gallons remaining. How much gasoline did he use each way? What was the total consumption for the round trip?

3. How many reams of paper are listed on the following invoice: $16\frac{1}{2}$ reams, $25\frac{2}{3}$ reams, $56\frac{3}{4}$ reams, $47\frac{2}{3}$ reams, and $18\frac{1}{8}$ reams?

4. A merchant bought ten bags of grain weighing $123\frac{1}{2}$, $124\frac{1}{4}$, $122\frac{3}{4}$, $120\frac{1}{2}$, $122\frac{1}{4}$, $119\frac{1}{4}$, $123\frac{1}{4}$, $121\frac{1}{2}$, $120\frac{1}{2}$, and $124\frac{1}{2}$ pounds. If the bags weighed $\frac{3}{4}$ of a pound each, what was the net weight of each bag of grain and the total weight of the grain?

5. During one week a farmer sold eggs as follows: Monday, $3\frac{1}{2}$ doz.; Tuesday, $4\frac{3}{4}$ doz.; Wednesday, $2\frac{5}{8}$ doz.; Thursday, $5\frac{1}{2}$ doz.; Friday, $3\frac{2}{3}$ doz.; Saturday, $4\frac{1}{4}$ doz. During that same week he kept for his own use: Monday, $2\frac{1}{3}$ doz.; Thursday, $3\frac{1}{4}$ doz. How many eggs did the chickens lay that week?

6. A merchant sold six boxes of merchandise weighing $97\frac{1}{2}$, $85\frac{3}{4}$, $50\frac{1}{3}$, $83\frac{5}{8}$, $92\frac{3}{8}$, and 91 pounds. Each box weighed $2\frac{1}{8}$ pounds. What was the gross weight of each box of merchandise and the total weight of the six boxes?

CHAPTER 19

MULTIPLICATION OF FRACTIONS

The multiplication of common fractions involves: (a) the multiplication of one fraction by another; (b) the multiplication of an integer by a fraction or a fraction by an integer; (c) the multiplication of two mixed numbers; or (d) the multiplication of a mixed number by an integer or an integer by a mixed number. Multiplication of fractions is indicated (a) by the multiplication sign, $\times$, or (b) by the word *of*, written between the two fractions to be multiplied.

$\frac{3}{4} \times \frac{5}{8}$ indicates that the product of the two fractions is to be ascertained.
 $\frac{5}{8}$ of $\frac{3}{4}$ indicates that the product of these two fractions is to be ascertained.

EXERCISE No. 56, MULTIPLICATION OF FRACTIONS

The following problems provide oral practice in multiplying one fraction by another. The product is obtained by multiplying the numerators to form the numerator of the product, and by multiplying the denominators to form the denominator of the product. Express each fraction in its lowest terms.

1	2	3	4	5
a. $\frac{2}{3} \times \frac{3}{4}$	a. $\frac{3}{5}$ of $\frac{2}{3}$	a. $\frac{4}{9} \times \frac{5}{6}$	a. $\frac{1}{2}$ of $\frac{7}{9}$	a. $\frac{3}{4}$ of $\frac{3}{5}$
b. $\frac{3}{8} \times \frac{3}{4}$	b. $\frac{3}{4}$ of $\frac{2}{3}$	b. $\frac{2}{5} \times \frac{5}{6}$	b. $\frac{2}{5}$ of $\frac{3}{7}$	b. $\frac{4}{7}$ of $\frac{3}{7}$
c. $\frac{1}{3} \times \frac{3}{8}$	c. $\frac{2}{7}$ of $\frac{1}{3}$	c. $\frac{3}{5} \times \frac{5}{6}$	c. $\frac{3}{5}$ of $\frac{2}{3}$	c. $\frac{5}{8}$ of $\frac{2}{4}$
d. $\frac{2}{3} \times \frac{1}{2}$	d. $\frac{4}{5}$ of $\frac{2}{3}$	d. $\frac{3}{5} \times \frac{5}{9}$	d. $\frac{1}{2}$ of $\frac{1}{8}$	d. $\frac{7}{8}$ of $\frac{3}{4}$
e. $\frac{5}{8} \times \frac{2}{3}$	e. $\frac{1}{5}$ of $\frac{3}{4}$	e. $\frac{1}{2} \times \frac{1}{2}$	e. $\frac{5}{6}$ of $\frac{1}{2}$	e. $\frac{5}{6}$ of $\frac{7}{8}$

EXERCISE No. 57, MULTIPLICATION OF FRACTIONS

The following problems provide practice in the multiplication of fractions. You are to show: (a) the multiplication process to ascertain the numerator; (b) the multiplication process to ascertain the denominator; and (c) the reduction process necessary to express the fraction in its lowest terms.

$$\frac{11}{36} \times \frac{9}{16} = \frac{99}{576}$$

$$\frac{99}{576} \div \frac{9}{9} = \frac{11}{64}$$

The illustration at the left shows the solution of $\frac{11}{36} \times \frac{9}{16}$. The product of the numerators (99) is placed over the product of the denominators (576). The fraction, reduced to its lowest terms, is $\frac{11}{64}$.

1	2	3	4	5
a. $\frac{16}{35} \times \frac{13}{22}$	a. $\frac{12}{41}$ of $\frac{15}{36}$	a. $\frac{72}{91} \times \frac{53}{84}$	a. $\frac{34}{49}$ of $\frac{28}{39}$	a. $\frac{45}{84} \times \frac{72}{93}$
b. $\frac{9}{40} \times \frac{21}{32}$	b. $\frac{27}{35}$ of $\frac{24}{31}$	b. $\frac{48}{53} \times \frac{23}{26}$	b. $\frac{34}{45}$ of $\frac{34}{45}$	b. $\frac{39}{62} \times \frac{42}{53}$
c. $\frac{15}{42} \times \frac{27}{35}$	c. $\frac{24}{29}$ of $\frac{37}{38}$	c. $\frac{45}{64} \times \frac{56}{83}$	c. $\frac{37}{48}$ of $\frac{72}{83}$	c. $\frac{35}{50} \times \frac{27}{43}$
d. $\frac{29}{42} \times \frac{7}{35}$	d. $\frac{18}{65}$ of $\frac{26}{27}$	d. $\frac{72}{83} \times \frac{45}{64}$	d. $\frac{56}{63}$ of $\frac{36}{49}$	d. $\frac{48}{53} \times \frac{37}{64}$
e. $\frac{24}{45} \times \frac{17}{22}$	e. $\frac{25}{44}$ of $\frac{45}{55}$	e. $\frac{27}{35} \times \frac{31}{50}$	e. $\frac{27}{56}$ of $\frac{64}{81}$	e. $\frac{63}{64} \times \frac{65}{72}$

EXERCISE No. 58, MULTIPLICATION BY CANCELLATION

When two or more fractions are to be multiplied and there are factors common to the numerators and the denominators, cancellation may be used before multiplying. This process reduces the calculations necessary to obtain the product. The cancellation process is as follows:

$$\frac{5}{6} \text{ of } \frac{12}{35} \text{ of } \frac{7}{9} = \frac{5}{6} \times \frac{12}{35} \times \frac{7}{9} = \frac{2}{9}$$

1	2	3
a. $\frac{5}{8}$ of $\frac{12}{25}$	a. $\frac{1}{2} \times \frac{4}{9} \times \frac{3}{4}$	a. $\frac{16}{35} \times \frac{27}{36} \times \frac{25}{32} \times \frac{18}{36}$
b. $\frac{3}{4}$ of $\frac{12}{15}$	b. $\frac{7}{8} \times \frac{2}{3} \times \frac{5}{7}$	b. $\frac{45}{56} \times \frac{35}{54} \times \frac{39}{64} \times \frac{24}{25}$
c. $\frac{3}{4}$ of 16	c. $\frac{5}{8} \times \frac{4}{5} \times \frac{5}{7}$	c. $\frac{27}{50} \times \frac{20}{63} \times 48 \times \frac{35}{24}$
d. $\frac{5}{8}$ of 24	d. $\frac{8}{9} \times \frac{5}{8} \times \frac{3}{5}$	d. $36 \times \frac{1}{24} \times \frac{15}{36} \times \frac{14}{15}$

EXERCISE No. 59, MULTIPLICATION OF MIXED NUMBERS

When a fraction is contained in either the multiplier or the multiplicand, it is best to multiply by the fraction first and then by the whole numbers. The method is illustrated below.

468	The solution at the left shows the process	385 $\frac{2}{5}$
44 $\frac{3}{4}$	of multiplying a whole number by a mixed number. $\frac{3}{4}$ of 468 is 351. This amount is	65
351	written as the first partial product in the	26
1872	solution. The whole numbers are then mul-	1925
1872	tiplied in the usual manner.	2310
20943	The solution at the right shows the process	25051
	of multiplying a mixed number by a whole number. $\frac{2}{5}$ of 65 is 26. This amount is written	

as the first partial product in the solution. The whole numbers are then multiplied in the usual manner.

The following problems provide practice in the multiplication of mixed numbers. Solve each problem according to the illustration, and prove the product by reverse multiplication.

- ✓ 1. $145\frac{1}{5} \times 85$ ✓ 5. $523\frac{1}{8} \times 48$ ✓ 9. $372 \times 45\frac{3}{4}$ ✓ 13. $565 \times 32\frac{3}{8}$
 2. $318\frac{1}{3} \times 99$ 6. $623 \times 55\frac{3}{7}$ 10. $256 \times 88\frac{5}{8}$ 14. $459 \times 27\frac{1}{5}$
 3. $423\frac{1}{2} \times 74$ 7. $560 \times 25\frac{3}{8}$ 11. $784 \times 16\frac{3}{4}$ 15. $875 \times 42\frac{5}{8}$
 4. $438\frac{5}{6} \times 36$ 8. $728 \times 57\frac{7}{8}$ 12. $272 \times 27\frac{1}{8}$ 16. $191 \times 22\frac{1}{2}$
17. 85 yards at $26\frac{3}{4}$ c a yard 19. $58\frac{1}{2}$ pounds at 11c a pound
 18. 506 pounds at $9\frac{1}{2}$ c a pound 20. 56 pounds at $37\frac{1}{2}$ c a pound

EXERCISE No. 60, MULTIPLICATION OF MIXED NUMBERS

When both the multiplier and the multiplicand are mixed numbers, there are two methods of solution: (a) multiply the fractions first and then multiply the whole numbers; (b) change the mixed numbers to improper fractions, multiply, and reduce. The illustrations given below show both methods applied to the problem, $228\frac{1}{2} \times 36\frac{2}{3}$.

$\begin{array}{r} 228\frac{1}{2} \\ 36\frac{2}{3} \\ \hline 152 \\ 18 \\ 1368 \\ 684 \\ \hline 8378\frac{1}{3} \end{array}$	The solution at the left shows the multiplication without the mixed numbers being changed to improper fractions. The product of the two fractions is $\frac{1}{3}$; the product of $228 \times \frac{2}{3}$ is 152; the product of $36 \times \frac{1}{2}$ is 18; the product of 228×6 is 1,368; the product of 228×3 is 684. The sum of the 5 partial products is $8,378\frac{1}{3}$.
---	---

The solution at the right shows the multiplication after the mixed numbers have been changed to improper fractions. The multiplicand is equivalent to the fraction $\frac{457}{3}$, and the multiplier, to the fraction $\frac{110}{3}$. The product of these two fractions will give the desired answer. In this case the 2 and 110 have a factor which is common; hence, cancellation is employed before multiplication.

The solution at the right shows the multiplication after the mixed numbers have been changed to improper fractions. The multiplicand is equivalent to the fraction $\frac{457}{3}$, and the multiplier, to the fraction $\frac{110}{3}$. The product of these two fractions will give the desired answer. In this case the 2 and 110 have a factor which is common; hence, cancellation is employed before multiplication.

It is suggested that you use the method at the left when the denominator of the fraction in the multiplier is exactly contained in the whole number of the multiplicand, and the denominator of the fraction in the multiplier is exactly contained in the whole number of the multiplier. When this is not the case, the method at the right should be used.

The following problems provide practice in multiplying mixed numbers. Show your calculations in either of the forms illustrated, and prove by reverse multiplication.

- ✓ 1. $368\frac{2}{7} \times 42\frac{5}{8}$ 5. $880\frac{5}{6} \times 48\frac{1}{4}$ 9. $878\frac{4}{5} \times 256\frac{3}{7}$ 13. $549\frac{5}{6} \times 72\frac{4}{5}$
 ✓ 2. $425\frac{1}{7} \times 27\frac{2}{3}$ 6. $785\frac{1}{5} \times 235\frac{3}{8}$ 10. $327\frac{1}{2} \times 124\frac{2}{3}$ 14. $785\frac{4}{5} \times 35\frac{3}{8}$
 3. $436\frac{1}{6} \times 25\frac{2}{3}$ 7. $496\frac{1}{5} \times 312\frac{5}{8}$ 11. $348\frac{2}{3} \times 27\frac{5}{8}$ 15. $924\frac{2}{3} \times 46\frac{5}{8}$
 4. $336\frac{2}{3} \times 48\frac{3}{4}$ 8. $425\frac{2}{5} \times 345\frac{3}{8}$ 12. $573\frac{2}{5} \times 45\frac{1}{5}$ 16. $384\frac{1}{2} \times 68\frac{1}{2}$
17. $246\frac{1}{4}$ yards at $24\frac{1}{2}$ c a yard 19. $128\frac{1}{4}$ pounds at $7\frac{1}{3}$ c a pound
 18. $35\frac{1}{2}$ tons at $\$5.62\frac{1}{2}$ a ton 20. $56\frac{1}{2}$ pounds at $11\frac{1}{3}$ c a pound

CHAPTER 20

PRACTICAL PROBLEMS

ORAL PROBLEMS

1. If a messenger boy earns $\$1\frac{1}{2}$ a day, six days a week, how much does he earn in a week?

2. You and your school chum form a partnership for selling papers after school hours. The two of you together sell 800 papers at 3c each during the week. A profit of $1\frac{1}{4}$ cents is made on each paper sold. On Saturday night, when the profits are divided equally, how much does each one receive?

3. You have kept an accurate account of your school expenses for the month, including lunch, school supplies, carfare, etc. The total for the month amounts to $\$12\frac{1}{2}$. Assume that there are 20 days to the school month. What were your average expenses for each day?

4. You buy tickets for your carfare at the rate of 6 for 51c. You use 2 tickets each day in a school month of 20 days. What is your carfare each month? If your school runs ten months, what will your carfare be for the year? How much will you save by walking $\frac{1}{5}$ of the time?

5. By selling eggs at 45c a dozen, you gain $\frac{2}{3}$ of a cent on each. How much would you gain on each by selling them at 48c a dozen?

6. At 36c a dozen what would be the cost of 224 eggs?

7. At $16\frac{2}{3}$ c a pound what will a 25-pound box of prunes cost?

8. At $16\frac{1}{2}$ c a pound what will $12\frac{1}{2}$ pounds of evaporated peaches cost?

9. I gain $1\frac{1}{3}$ c on each apple I sell at 5c. What would I lose by selling the apples at 3 for 10c?

10. Mrs. Brown bought two chickens weighing $3\frac{1}{4}$ and $3\frac{1}{2}$ pounds respectively, at 28c a pound. How much change will she get from a \$5 bill?

WRITTEN PROBLEMS

1. In a test an automobile ran 28 miles in 30 minutes. At this rate how many miles would it travel in $6\frac{1}{2}$ hours?

2. Find the cost of $26\frac{1}{2}$ pounds of prunes at $17\frac{1}{2}c$ a pound and $16\frac{1}{2}$ pounds of raisins at $15\frac{3}{4}c$ a pound.

3. A farmer sold to a merchant 14 dozen eggs at $32\frac{1}{4}c$ and $16\frac{1}{2}$ pounds of butter at $34c$. He purchased from the merchant 6 pounds of sugar at $7\frac{1}{2}c$ and 4 pounds of coffee at $28\frac{1}{2}c$. Who pays the difference, the farmer or the merchant? How much?

4. What is the cost of $14\frac{1}{2}$ gross of notebooks at $4\frac{3}{4}c$ a notebook?

NOTE: A gross is 12 dozen.

5. A box of apples containing 144 apples was purchased at $2\frac{1}{2}c$ an apple and sold at $\frac{6}{5}$ of the cost. What was the profit?

6. Find the cost of 5 tubs of butter weighing $33\frac{1}{2}$ pounds, $34\frac{1}{2}$ pounds, $31\frac{1}{8}$ pounds, $30\frac{3}{4}$ pounds, and $31\frac{1}{3}$ pounds, if the tubs average $4\frac{1}{2}$ pounds each and the butter is billed at $27\frac{3}{4}c$ a pound.

7. A merchant bought 12 pieces of denim as follows: $40\frac{1}{2}$, $43\frac{1}{2}$, $41\frac{1}{4}$, $41\frac{1}{2}$, $44\frac{1}{4}$, $43\frac{3}{4}$, $40\frac{1}{2}$, $40\frac{1}{4}$, $42\frac{1}{2}$, $41\frac{3}{4}$, $42\frac{1}{4}$, $40\frac{1}{2}$ yards at $16\frac{2}{3}c$ a yard. What was the cost?

8. Alfred Johnson works the following number of hours during the seven days beginning with Monday, May 9: Monday, $9\frac{2}{5}$; Tuesday, $9\frac{3}{4}$; Wednesday, $10\frac{3}{10}$; Thursday, $7\frac{7}{10}$; Friday, $9\frac{3}{4}$; Saturday, $9\frac{3}{4}$; Sunday, $8\frac{1}{2}$. His wages are $\$1.23\frac{1}{4}$ an hour for eight hours in each week day. He is allowed time and a half for all time over eight hours in each week day and double time for Sunday. How much was due him for the time worked during the seven days?

9. I bought 10 bags of wheat weighing $120\frac{1}{2}$, $122\frac{1}{4}$, $119\frac{3}{4}$, $121\frac{1}{2}$, $122\frac{3}{4}$, $119\frac{1}{2}$, $122\frac{1}{2}$, $120\frac{1}{4}$, 121, and $123\frac{1}{4}$ pounds respectively. If I paid $\$1.55$ a bushel, and each bag weighed one pound, what was the cost of the wheat?

10. What is the selling price of three bales of cotton weighing $498\frac{1}{2}$ pounds, $502\frac{3}{4}$ pounds, and $501\frac{3}{8}$ pounds at $14c$ a pound?

11. A merchant had a pecan grove of 125 trees that averaged 55 pounds to the tree. He sold one-half of his crop at $10\frac{1}{2}c$ a pound and the other half at $12\frac{1}{2}c$ a pound. How much did he receive for the entire crop?

12. H. B. Fall, a farmer, sold 22,581 pounds of seed cotton at $7\frac{3}{4}c$ a pound. How much did he receive for it?

13. A boy earns \$6 for $10\frac{1}{2}$ hours of work in each week; another boy earns 50 cents an hour for 2 hours and 15 minutes of work on each of six days. Each boy deposits $\frac{1}{4}$ of his weekly earnings in a savings account in a bank. (a) What is the difference in the weekly earnings of each boy? (b) in the weekly savings?

14. Mrs. Smith bought the following dry goods: $4\frac{1}{2}$ yards pongee at \$1.12 a yard; 6 yards muslin at $18\frac{1}{4}c$ a yard; 16 yards filet lace edging at $8\frac{1}{2}c$ a yard. What was the total amount of her purchase?

15. How much will it cost to build 94 feet of wire fence at $\$1.56\frac{1}{2}$ a foot?

16. Robert Douglas owed Brown Brothers, retail merchants, \$187.65. What was the balance of his indebtedness if Brown Brothers accepted in part payment 127 dozen eggs at $31\frac{1}{2}c$ a dozen and 62 pounds of butter at $39\frac{1}{2}c$ a pound?

17. The Santa Fe Railroad presented a freight bill for hauling 15,500 pounds of grain at a cost of $17\frac{1}{2}c$ a hundred pounds. A local drayage company charged $12\frac{1}{2}c$ a hundred pounds for delivery to the warehouse. Find the total freight and drayage cost.

18. The San Francisco Warehouse Company delivered to the Southern Pacific Railroad 3 cases of books to be shipped to Salt Lake City. The cases weighed 1,815 pounds. The freight rate was $\$2.16\frac{1}{2}$ a hundred pounds. The warehouse charged $17\frac{1}{2}c$ a case for storage and $12\frac{1}{2}c$ a case for delivery to the station. Find the total transportation and warehouse cost.

19. A New York concern has a branch in Los Angeles, to which it makes many shipments during the year. It can ship by water at a rate of $\$1.87\frac{1}{2}$ a hundred pounds. The railroad rate is $\$2.08\frac{1}{2}$ a hundred pounds. If the average carload weighs 42,500 pounds, what is the saving from a water shipment?

20. A mechanic gets $42\frac{1}{2}c$ an hour. He works 8 hours on each of 5 days and $4\frac{1}{2}$ hours on Saturday. His street-car tickets are purchased at the rate of four for $25c$. What is his weekly wage after car fare is deducted?

21. By rearranging old machinery and installing new machinery, a factory increased production by $\frac{1}{3}$. Then the working hours were reduced from 10 to 8 hours. Was there a net increase or a decrease in production? How much?

22. Two brothers paid \$2,400 for a farm, each paying $\frac{1}{2}$. Each sold $\frac{1}{4}$ of his interest to a third brother at cost. (a) What fractional part of the total investment does each brother now own? (b) What is the value of the investment of each?

23. A, B, and C are partners in a business, each owning $\frac{1}{3}$. A sold $\frac{1}{3}$ of his interest to B and the remainder to C. What part do B and C each now own?

24. A, B, and C are partners. A invested \$2,850; B invested \$3,120; and C invested \$5,400. What fractional part of the capital did each invest?

25. The average yield of 150 acres of corn was 60 bushels. The owner of the farm sold one-half of the crop at $57c$ a bushel; one-third of the remainder at $62c$ a bushel; and kept what was left for his own stock. (a) How much did the farmer receive for the corn? (b) How many bushels did he keep for his own use?

26. If a field is 250 feet long and 375 feet wide, how much will it cost to enclose it with a fence at $59c$ a yard?

27. What is the cost of 8 bags of wheat weighing $96\frac{1}{4}$, $98\frac{1}{2}$, $85\frac{1}{3}$, $79\frac{9}{10}$, $65\frac{4}{5}$, $80\frac{1}{3}$, $91\frac{2}{3}$, and $89\frac{9}{10}$ pounds if the wheat sells at $75c$ a bushel?

CHAPTER 21

BUSINESS PRACTICE

EXERCISE No. 61, MAKING CHANGE

1. You gave a clerk a five-dollar bill in payment for the following: 4 pounds of coffee at $35\frac{3}{4}$ c; 6 pounds of onions at $6\frac{1}{2}$ c; $12\frac{1}{4}$ pounds of flour at 4c; $\frac{1}{2}$ pound of pepper at 48c a pound. (a) How much change should you receive? (b) In what denominations should it be given to you?

2. If you paid $8\frac{1}{4}$ c a yard for $10\frac{1}{2}$ yards of ribbon and $16\frac{2}{3}$ c a yard for 9 yards of gingham, (a) what change would you receive from a five-dollar bill? (b) In what denominations would the change be given to you?

3. I gave a twenty-dollar bill in payment of 9 pounds of nuts at $16\frac{2}{3}$ c a pound, 12 pounds of coffee at $37\frac{1}{2}$ c a pound, and $12\frac{1}{2}$ pounds of butter at 48c a pound. What change should I receive?

4. The Creasey Wholesale Grocery Company sold for cash to the T. F. Cook Company the following merchandise on April 1. A check for \$1,500 was given in payment. How much change was due the T. F. Cook Company?

50 bbls. sugar (15,539 $\frac{1}{2}$ lbs.)	@	8 $\frac{1}{2}$ c a lb.
1 bbl. molasses (51 $\frac{1}{4}$ gals.)	@	64 $\frac{1}{2}$ c a gal.
102 lbs. cheese	@	29 $\frac{1}{2}$ c a lb.
15 doz. lemons	@	36 $\frac{1}{2}$ c a doz.
8 $\frac{1}{2}$ bags of potatoes	@	\$1.95 a bag
28 $\frac{1}{2}$ lbs. lard	@	28 $\frac{1}{4}$ c a lb.
10 $\frac{1}{2}$ doz. cans asparagus	@	\$2.80 a doz.
12 doz. bars Grandma's soap	@	61 $\frac{1}{4}$ c a doz.

5. Ascertain the amount of the following cash sale made by the Fair Store on May 18 to Ronald Smith. A \$50 bill was given in payment. How much change was due Ronald Smith?

29 $\frac{1}{2}$ yards of fancy outing flannel	@	19 $\frac{1}{3}$ c a yard
14 $\frac{1}{2}$ yards dress gingham	@	18 $\frac{3}{4}$ c " "
27 $\frac{3}{4}$ yards of windsor crepe	@	22 $\frac{1}{3}$ c " "

35 $\frac{1}{4}$ yards of challie	@ 16 $\frac{1}{2}$ c a yard
36 $\frac{1}{2}$ yards of white dimity	@ 19 $\frac{1}{4}$ c " "

6. On May 5 Donaldson Brothers, wholesale dry goods merchants, sold P. W. Smith the following merchandise for cash. A draft for \$600 was given in payment. How much change was due P. W. Smith?

6 pieces flannel @ 39 ³ , 37 ² , 40, 38 ³ , 39 ¹ , 40 ¹	75 $\frac{3}{8}$ c a yard
6 pieces gingham @ 58 ³ , 59 ¹ , 57 ³ , 56 ² , 59 ¹ , 58 ¹	19c a yard
8 pieces prints @ 42 ¹ , 43 ³ , 44 ¹ , 44 ³ , 45 ¹ , 44 ² , 43 ³ , 45	16 $\frac{3}{4}$ c a yard
12 pieces linings @ 44 ¹ , 44 ³ , 45 ² , 46 ¹ , 47, 48, 44 ³ , 43 ³ , 45 ¹ , 46 ² , 48 ³ , 47	39 $\frac{1}{4}$ c a yard

NOTE: The figures under the descriptions of the goods refer to the number of yards in each piece. The small figures indicate fourths of a yard.

7. On May 10 Simon, Tucker & Company, wholesale dry goods merchants, made the following cash sale to B. T. Frank & Co. A check for \$1,000 was given in payment. How much change was due B. T. Frank & Co.?

8 pieces prints @ 41 ¹ , 42 ² , 39 ³ , 40 ¹ , 41 ³ , 41 ² , 40 ² , 39 ³	13 $\frac{3}{4}$ c a yard
8 pieces chiffon @ 37 ² , 38 ³ , 40 ² , 42 ¹ , 41 ³ , 37 ¹ , 39 ² , 41 ³	1.85 a yard
6 pieces percale @ 56 ¹ , 54 ² , 53 ¹ , 53 ² , 54 ³ , 52 ³	16 $\frac{1}{2}$ c a yard
4 pieces taffeta @ 49 ³ , 53 ¹ , 54 ² , 51 ²	1.47 a yard

8. The Chatfield Paper Company sold the Goodwill Printing Company for cash the following merchandise on November 16:

12 $\frac{1}{2}$ rms. Snowdrift Writing, 17×22, 24 lbs. a rm.	@ 37 $\frac{1}{2}$ c a lb.
25 $\frac{2}{5}$ rms. Foldwell Writing, 22×34, 48 lbs. a rm.	@ 18 $\frac{1}{2}$ c a lb.
57 $\frac{4}{5}$ rms. Paramount Bond, 17×28, 20 $\frac{1}{2}$ lbs. a rm.	@ 13 $\frac{3}{4}$ c a lb.
42 $\frac{2}{5}$ rms. Triton Bond, 17×28, 25 $\frac{1}{2}$ lbs. a rm.	@ 15 $\frac{1}{4}$ c a lb.

The Chatfield Paper Company received a check for \$750 in payment. How much change was due the Goodwill Printing Company?

9. The Albany Company sold the Thomas Company for cash the following merchandise on March 16: $37\frac{1}{2}$ pounds of tea @ $62\frac{1}{2}c$ a pound; $42\frac{1}{2}$ pounds of coffee @ $41\frac{3}{4}c$ a pound; $5\frac{1}{2}$ pounds of pepper at $58\frac{1}{2}c$ a pound; $37\frac{1}{2}$ pounds of lard at $25\frac{1}{2}c$ a pound. The Albany Company received a \$75 bank draft in payment. How much change was due the Thomas Company?

EXERCISE No. 62, INVENTORY

1. Ascertain the value of the following drugs in the stock of the Dow Drug Company on December 31:

126 $\frac{1}{4}$ doz. Mulsified Cocoanut Oil	@ 24 $\frac{1}{2}c$ each
151 doz. D. & R. Cold Cream	@ 26 $\frac{3}{4}c$ "
125 doz. Mavis Talcum Powder	@ 13 $\frac{1}{2}c$ "
49 doz. Pinaud's Lilac Vegetal	@ 62 $\frac{1}{2}c$ "
46 $\frac{3}{4}$ doz. Pepsodent Tooth Paste	@ 25 $\frac{1}{2}c$ "
58 doz. Lyons' Tooth Paste	@ 32 $\frac{3}{4}c$ "
56 $\frac{1}{4}$ doz. Palmolive Shampoo	@ 28 $\frac{3}{4}c$ "
62 $\frac{1}{2}$ doz. Vick's Salve	@ 41 $\frac{1}{4}c$ "

2. Verify the following inventory of automobile accessories in the stock of the Western Auto Supply Company on December 31:

Merchandise Inventory, December 31, 19

45 Seat Covers.....	7.57	340 65		
26 Seat Covers.....	6.97 $\frac{1}{2}$	181 35		
88 pairs Gauntlets.....	1.96 $\frac{1}{2}$	173 92		
158 Steel Ratchet Valve Lifters....	.16 $\frac{1}{4}$	25 67		
253 Grease Guns.....	.46 $\frac{1}{2}$	122 64		
74 Rubber Mats.....	.45 $\frac{3}{4}$	34 03		
56 pkgs. Top Patching Material..	.26 $\frac{1}{3}$	12 85		
153 bottles Top Dressing.....	.35 $\frac{2}{3}$	50 55		
584 Carburetor Adjusters.....	.76 $\frac{1}{2}$	446 78		
352 Piston Rings.....	.08 $\frac{1}{2}$	29 78		
226 Timers.....	.36 $\frac{1}{4}$	81 83		
158 Headlamp Reflectors.....	.56 $\frac{1}{2}$	89 27		
74 Headlamp Rims.....	.27 $\frac{1}{4}$	20 27		
148 Stoplites.....	.57 $\frac{1}{4}$	84 73		
96 Aluminum Step Plates.....	.87 $\frac{1}{4}$	83 76		
Total.....			1778 08	

Show: (a) the calculations necessary to verify the extensions and (b) the correct total of the inventory.

CHAPTER 22

DIVISION OF FRACTIONS

The division of common fractions involves: (a) division of one fraction by another; (b) division of an integer by a fraction or a fraction by an integer; (c) division of one mixed number by another; or (d) division of a mixed number by an integer or an integer by a mixed number.

EXERCISE No. 63, DIVISION OF FRACTIONS

The following problems provide oral practice in the division of fractions. The numerator of the quotient is obtained by dividing the numerator of the dividend by the numerator of the divisor; the denominator of the quotient is obtained by dividing the denominator of the dividend by the denominator of the divisor. When the quotient is an improper fraction, reduce it to a mixed number with the fraction of the mixed number in its lowest terms. With each answer state whether the quotient is of greater or less value than the dividend.

1	2	3	4	5
a. $\frac{1}{2} \div \frac{1}{2} =$	a. $\frac{8}{21} \div \frac{4}{7} =$	a. $\frac{6}{15} \div \frac{2}{3} =$	a. $\frac{18}{36} \div \frac{6}{18} =$	a. $\frac{13}{60} \div \frac{13}{15} =$
b. $\frac{1}{4} \div \frac{1}{2} =$	b. $\frac{8}{25} \div \frac{2}{5} =$	b. $\frac{4}{10} \div \frac{4}{5} =$	b. $\frac{22}{34} \div \frac{11}{17} =$	b. $\frac{18}{75} \div \frac{9}{25} =$
c. $\frac{3}{4} \div \frac{3}{4} =$	c. $\frac{9}{26} \div \frac{3}{2} =$	c. $\frac{7}{22} \div \frac{7}{2} =$	c. $\frac{27}{45} \div \frac{9}{15} =$	c. $\frac{27}{90} \div \frac{9}{30} =$
d. $\frac{4}{9} \div \frac{2}{3} =$	d. $\frac{14}{39} \div \frac{7}{3} =$	d. $\frac{6}{32} \div \frac{1}{2} =$	d. $\frac{18}{34} \div \frac{9}{17} =$	d. $\frac{55}{66} \div \frac{5}{11} =$

EXERCISE No. 64, DIVISION OF FRACTIONS

When the numerator of the divisor is not exactly contained in the numerator of the dividend, and the denominator of the divisor is not exactly contained in the denominator of the dividend, it is more convenient to invert the divisor and to multiply. $\frac{7}{8} \div \frac{7}{16} = 2$ is the same as $\frac{7}{8} \times \frac{16}{7} = 2$. The 7's cancel each other, and 8 is contained in 16 two times; hence, the quotient is 2. In other words, $\frac{7}{16}$ is contained in $\frac{7}{8}$ two times. This may be proved by multiplying $\frac{7}{16}$ by 2. ($\frac{7}{16} \times 2 = \frac{14}{16} = \frac{7}{8}$.)

The following problems provide oral practice in division when it is necessary to invert the divisor.

- | | | | | |
|-------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|--|
| 1. $\frac{1}{2} \div \frac{1}{4} =$ | 6. $\frac{1}{5} \div \frac{1}{2} =$ | 11. $\frac{5}{8} \div \frac{2}{3} =$ | 16. $\frac{5}{12} \div \frac{5}{8} =$ | 21. $\frac{2}{3} \div \frac{1}{3} =$ |
| 2. $\frac{1}{2} \div \frac{1}{3} =$ | 7. $\frac{1}{5} \div \frac{1}{4} =$ | 12. $\frac{1}{8} \div \frac{3}{5} =$ | 17. $\frac{9}{22} \div \frac{2}{7} =$ | 22. $\frac{1}{10} \div \frac{5}{15} =$ |
| 3. $\frac{1}{3} \div \frac{1}{2} =$ | 8. $\frac{1}{5} \div \frac{1}{8} =$ | 13. $\frac{1}{7} \div \frac{7}{8} =$ | 18. $\frac{2}{3} \div \frac{4}{5} =$ | 23. $\frac{2}{3} \div \frac{3}{8} =$ |
| 4. $\frac{2}{3} \div \frac{1}{2} =$ | 9. $\frac{1}{2} \div \frac{1}{5} =$ | 14. $\frac{4}{7} \div \frac{3}{7} =$ | 19. $\frac{1}{2} \div \frac{5}{6} =$ | 24. $\frac{3}{5} \div \frac{3}{5} =$ |
| 5. $\frac{1}{2} \div \frac{2}{3} =$ | 10. $\frac{1}{3} \div \frac{1}{6} =$ | 15. $\frac{5}{9} \div \frac{3}{5} =$ | 20. $\frac{2}{3} \div \frac{7}{8} =$ | 25. $\frac{2}{3} \div \frac{3}{8} =$ |

EXERCISE No. 65, DIVISION OF MIXED NUMBERS

When a problem requires the division of an integer by a mixed number, or vice versa, change the mixed number to an improper fraction, invert the divisor, multiply, and reduce the quotient to a mixed number with the fraction in its lowest terms. If you so desire, the integer and the mixed number may each be multiplied by the denominator of the fraction, and the fraction may thereby be removed. The process of division is then completed as in the division of whole numbers, and the quotient is expressed as a mixed number with the fraction reduced to its lowest terms.

The solution at the left shows the process when a mixed number is changed to an improper fraction and the divisor is inverted.

$84 \div 4\frac{1}{3} = 84 \div \frac{13}{3} =$ $\frac{84}{1} \times \frac{3}{13} = \frac{252}{13} = 19\frac{5}{13}$	The solution at the right shows the proc- ess when both the div- idend and the divisor	$84 \times 3 = 252; 4\frac{1}{3} \times 3 = 13$ $252 \div 13 = 19\frac{5}{13}$
---	---	---

are multiplied by the denominator of the fraction and the division is completed as in division of whole numbers.

The following problems provide practice in dividing an integer by a mixed number and a mixed number by an integer. You may solve the problems by either of the methods illustrated above, and may prove the results by the other method.

- | ✓ 1 | ✓ 2 | 3 |
|--------------------------------|---------------------------------|------------------------------|
| ✓ a. $176 \div 7\frac{2}{3} =$ | ✓ a. $427\frac{1}{3} \div 16 =$ | a. $729 \div 8\frac{2}{7} =$ |
| ✓ b. $132 \div 5\frac{6}{7} =$ | ✓ b. $141\frac{1}{2} \div 23 =$ | b. $520 \div 8\frac{4}{5} =$ |
| c. $237 \div 3\frac{3}{4} =$ | c. $375\frac{2}{3} \div 41 =$ | c. $360 \div 5\frac{2}{3} =$ |
| d. $435 \div 8\frac{5}{8} =$ | d. $245\frac{5}{6} \div 17 =$ | d. $475 \div 8\frac{3}{4} =$ |
| e. $682 \div 9\frac{2}{3} =$ | e. $308\frac{2}{3} \div 21 =$ | e. $178 \div 5\frac{2}{3} =$ |

EXERCISE No. 66, DIVISION OF MIXED NUMBERS

When a problem requires the division of one mixed number by another mixed number, change both mixed numbers to improper fractions, invert the divisor, multiply, and reduce the quotient to a mixed number with the fraction in its lowest terms. Cancellation should be used when possible.

The following problems provide practice in the division of mixed numbers.

✓ 1	✓ 2	3
✓ a. $3\frac{1}{2} \div 2\frac{1}{2} =$	✓ a. $16\frac{2}{3} \div 6\frac{2}{3} =$	a. $18\frac{3}{5} \div 12\frac{2}{3} =$
✓ b. $7\frac{1}{3} \div 2\frac{1}{2} =$	✓ b. $18\frac{3}{4} \div 6\frac{1}{4} =$	b. $58\frac{1}{3} \div 12\frac{1}{2} =$
c. $9\frac{1}{4} \div 7\frac{1}{2} =$	c. $12\frac{1}{2} \div 4\frac{1}{2} =$	c. $93\frac{3}{4} \div 16\frac{2}{3} =$
d. $5\frac{1}{3} \div 4\frac{1}{3} =$	d. $22\frac{4}{9} \div 7\frac{2}{3} =$	d. $64\frac{3}{8} \div 15\frac{1}{3} =$
e. $6\frac{1}{6} \div 3\frac{1}{3} =$	e. $27\frac{3}{8} \div 3\frac{1}{2} =$	e. $52\frac{2}{9} \div 27\frac{4}{5} =$
f. $8\frac{2}{3} \div 2\frac{1}{3} =$	f. $32\frac{6}{7} \div 4\frac{3}{7} =$	f. $45\frac{3}{4} \div 22\frac{1}{2} =$

EXERCISE No. 67, FRACTIONAL RELATIONS

When the relation of one number to another is to be shown, it is indicated by placing the numbers in the form of a fraction. Thus, if the relation of 5 to 20 is to be determined, the result expressed as a fraction is $\frac{5}{20}$, which reduced to its lowest terms is $\frac{1}{4}$; hence, 5 is $\frac{1}{4}$ of 20.

The following problems provide oral practice in determining the relation of numbers.

NOTE: The mental process of solution applied to the first problem would be: 2 is $\frac{1}{20}$ of 40 because the fraction $\frac{2}{40}$ is $\frac{1}{20}$ in its lowest terms; 4 is $\frac{1}{10}$ of 40 because the fraction $\frac{4}{40}$ reduced to its lowest terms is $\frac{1}{10}$; 8 is $\frac{1}{5}$ of 40 because the fraction $\frac{8}{40}$ reduced to its lowest terms is $\frac{1}{5}$, etc.

What fractional part of:

- 40 is 2; 4; 8; 10; 20?
- 24 is 2; 3; 4; 6; 8; 12?
- 72 is 2; 3; 4; 6; 8; 9; 12; 18; 24; 36?
- 48 is 2; 3; 4; 6; 8; 12; 24?
- 50 is 2; 5; 10; 25?
- 56 is 2; 4; 7; 8; 14; 28?
- 80 is 2; 4; 5; 8; 10; 16; 20; 40?
- 63 is 3; 7; 9; 21?

EXERCISE No. 68, FRACTIONAL RELATIONS

When the fractional part of a number is expressed as an integer, the value of the number may be determined by dividing the integer by the numerator and multiplying the result by the denominator of the fraction. If $\frac{2}{3}$ of a number is 20, and the number is to be determined, the following reasoning process will apply:

If $\frac{2}{3}$ of a certain number is 20, then $\frac{1}{3}$ of that number is $20 \div 2$ or 10; if $\frac{1}{3}$ of the desired number is 10, then $\frac{3}{3}$ of it is 3×10 , or 30.

The following problems provide oral practice in determining the number when a part of it is expressed as an integer.

- | 1 | 2 | 3 |
|-----------------------------|------------------------------|------------------------------|
| a. 27 is $\frac{3}{4}$ of ? | a. 14 is $\frac{7}{8}$ of ? | a. 16 is $\frac{8}{9}$ of ? |
| b. 15 is $\frac{3}{5}$ of ? | b. 27 is $\frac{3}{5}$ of ? | b. 21 is $\frac{3}{5}$ of ? |
| c. 16 is $\frac{4}{5}$ of ? | c. 24 is $\frac{6}{7}$ of ? | c. 25 is $\frac{5}{6}$ of ? |
| d. 12 is $\frac{2}{3}$ of ? | d. 18 is $\frac{3}{4}$ of ? | d. 32 is $\frac{8}{9}$ of ? |
| e. 26 is $\frac{1}{4}$ of ? | e. 20 is $\frac{1}{11}$ of ? | e. 28 is $\frac{1}{15}$ of ? |

EXERCISE No. 69, FRACTIONAL RELATIONS

The following problems provide practice in determining the number when a part of it is expressed as a mixed number or a fraction.

NOTE: The process is the same with a mixed number or a fraction as with an integer. When there is a mixed number in the problem, this should be changed to an improper fraction.

- | 1 | 2 | 3 |
|--|--|--|
| a. $87\frac{1}{2}$ is $\frac{7}{8}$ of ? | a. $27\frac{1}{6}$ is $\frac{3}{8}$ of ? | a. $36\frac{3}{8}$ is $\frac{3}{9}$ of ? |
| b. $33\frac{1}{3}$ is $\frac{1}{3}$ of ? | b. $25\frac{3}{5}$ is $\frac{4}{7}$ of ? | b. $35\frac{3}{5}$ is $\frac{2}{7}$ of ? |
| c. $12\frac{5}{6}$ is $\frac{7}{8}$ of ? | c. $36\frac{1}{8}$ is $\frac{3}{5}$ of ? | c. $47\frac{1}{5}$ is $\frac{4}{5}$ of ? |
| d. $35\frac{3}{5}$ is $\frac{3}{4}$ of ? | d. $42\frac{1}{3}$ is $\frac{3}{7}$ of ? | d. $71\frac{1}{3}$ is $\frac{3}{4}$ of ? |
| e. $\frac{8}{9}$ is $\frac{3}{4}$ of ? | e. $\frac{3}{4}$ is $\frac{2}{3}$ of ? | e. $\frac{7}{9}$ is $\frac{1}{3}$ of ? |

EXERCISE No. 70, COMPLEX FRACTIONS

The division of fractions may be expressed in the form of a complex fraction, that is, one fraction over another. If mixed numbers are involved, it is customary to change them to improper

fractions when expressed as a complex fraction. The illustrations show the solution of the problem $7\frac{1}{8} \div 5\frac{1}{7}$.

$$7\frac{1}{8} \div 5\frac{1}{7} = \frac{7\frac{1}{8}}{5\frac{1}{7}} = \frac{\frac{57}{8}}{\frac{36}{7}} = \frac{57}{8} \times \frac{7}{36} = \frac{399}{288} = \frac{133}{96} = 1\frac{37}{96}$$

In this solution the mixed numbers are changed to improper fractions expressed as a complex fraction. Since the numerator is the dividend and the denominator is the divisor, the process of division here can be expressed as a complex fraction in the form of either mixed numbers or improper fractions. $\frac{57}{8} \div \frac{36}{7}$ is equivalent to multiplication when the terms of the divisor are inverted. The product, reduced to the form of a mixed number with the fraction in its lowest terms, gives the number of times $5\frac{1}{7}$ is contained in $7\frac{1}{8}$.

$$7\frac{1}{8} \div 5\frac{1}{7} = \frac{\frac{57}{8}}{\frac{36}{7}} = \frac{57}{8} \times \frac{7}{36} = \frac{399}{288} = 1\frac{111}{88} = 1\frac{37}{96}$$

Another method of performing the division indicated by a complex fraction is to multiply the two extreme numbers to obtain a new numerator and the two mean numbers to obtain a new denominator. You will note by comparing this solution with that in the first illustration that the result is the same as that obtained when the divisor is inverted and the numbers are then multiplied.

$$7\frac{1}{8} \div 5\frac{1}{7} = \frac{\frac{57}{8}}{\frac{36}{7}} = \frac{7 \times 19}{8 \times 12} = \frac{133}{96} = 1\frac{37}{96}$$

In this solution the cancellation is completed before multiplying the extremes to obtain a numerator and the means to obtain a denominator. Referring to the second solution, you will observe that cancellation could have been used before the multiplication process, but that the reduction was not made until after the improper fraction had been reduced to a mixed number. The final results of the three processes are the same; hence, one may be used as a means of proving the other.

The following problems provide practice in the division of fractions when they are expressed in complex form.

1	2	3	4	5
a. $\frac{6\frac{3}{5}}{4\frac{1}{2}}$	a. $\frac{3\frac{3}{8}}{5\frac{9}{7}}$	a. $\frac{10\frac{2}{3}}{12\frac{3}{4}}$	a. $\frac{42\frac{7}{8}}{36\frac{1}{4}}$	a. $\frac{58\frac{1}{4}}{32\frac{1}{7}}$
b. $\frac{5\frac{2}{3}}{6\frac{1}{3}}$	b. $\frac{3\frac{2}{3}}{7\frac{8}{9}}$	b. $\frac{17\frac{1}{2}}{11\frac{1}{5}}$	b. $\frac{39\frac{1}{7}}{24\frac{1}{3}}$	b. $\frac{43\frac{2}{5}}{27\frac{1}{3}}$
c. $\frac{4\frac{2}{7}}{5\frac{3}{8}}$	c. $\frac{8\frac{3}{9}}{4\frac{1}{2}}$	c. $\frac{23\frac{2}{5}}{16\frac{3}{4}}$	c. $\frac{45\frac{1}{5}}{19\frac{5}{6}}$	c. $\frac{36\frac{1}{6}}{18\frac{1}{4}}$

EXERCISE No. 71, FRACTIONS APPLIED TO DENOMINATE NUMBERS

When a fraction is applicable to an abstract number and is expressed in its lowest terms, there is no other means of expressing the fractional value. When a fraction is applicable to a concrete number, its value may be expressed in other concrete terms which bear a definite relation to the concrete number. Thus, the fraction $\frac{3}{4}$ indicates that an abstract unit is divided into 4 equal parts and that 3 parts are expressed. The expression " $\frac{3}{4}$ of a dozen" is applicable to 12 because 12 units make a dozen hence, might be expressed as 9. The fraction " $\frac{1}{2}$ of a bushel" might be expressed as 2 pecks because there are 4 pecks in a bushel.

The following problems provide oral practice in expressing in another form a fractional value applicable to a concrete number. These problems serve two purposes: (a) a review of measurements, and (b) the expression of a fraction in more than one form without a change in its value.

1	2	3
a. $\frac{3}{4}$ of a yard	a. $\frac{3}{4}$ of a pound	a. $\frac{1}{2}$ of a ton
b. $\frac{5}{8}$ of a bushel	b. $\frac{1}{2}$ of a quart	b. $\frac{3}{4}$ of a dollar
c. $\frac{3}{4}$ of a gallon	c. $\frac{2}{3}$ of a yard	c. $\frac{1}{5}$ of a quarter
d. $\frac{5}{6}$ of a foot	d. $\frac{1}{4}$ of a gallon	d. $\frac{1}{2}$ of a rod
e. $\frac{7}{12}$ of a dozen	e. $\frac{3}{8}$ of a pound	e. $\frac{1}{8}$ of a pound
f. $\frac{1}{2}$ of a bushel	f. $\frac{2}{5}$ of a quarter	f. $\frac{2}{5}$ of a yard
g. $\frac{1}{4}$ of a foot	g. $\frac{1}{4}$ of a rod	g. $\frac{1}{4}$ of a dozen
h. $\frac{5}{6}$ of a dozen	h. $\frac{1}{4}$ of a ton	h. $\frac{6}{20}$ of a dollar
i. $\frac{1}{4}$ of a quart	i. $\frac{5}{12}$ of a foot	i. $\frac{4}{5}$ of a quarter
j. $\frac{3}{20}$ of a dollar	j. $\frac{1}{100}$ of a ton	j. $\frac{5}{100}$ of a ton

CHAPTER 23

PRACTICAL PROBLEMS AND PROJECT

ORAL PROBLEMS

1. A merchant's debts amount to \$2,500, which is $\frac{1}{7}$ of his assets. What is the value of his assets and what is his net worth?

NOTE: Assets - debts = net worth.

2. The stock of a bankrupt merchant was sold for \$24,000, which was $\frac{2}{3}$ of the cost. What was the cost of the stock? What was the loss?

3. What will $2\frac{1}{4}$ yards of silk cost at \$5 $\frac{1}{2}$ a yard?

4. Bananas are priced at 40c a dozen. How many can you buy for 10c?

5. A merchant sells apples at 3 for 10c. If a box contains 120 apples, what will he get for it? If he bought the apples at the rate of 4 for 10c, what is his gross profit on the box of apples?

6. A family saves \$960 a year, which is $\frac{3}{8}$ of its income. What is the income?

7. If you perform $\frac{1}{12}$ of a certain piece of work in the first week, working 6 days a week, how many days will it take to complete the task?

8. If a boy can earn 3 $\frac{1}{2}$ dollars a day, how much will he earn in a month of 26 working days?

9. The athletic association of a school collected \$820 for the year. $\frac{1}{8}$ was for basket ball, $\frac{1}{4}$ for baseball, $\frac{1}{2}$ for football, and the remainder for hockey. How much was collected for each?

10. A farmer sold $\frac{4}{9}$ of his apples for \$120. What was the value of the entire crop?

11. A girl bought 4 apples at 5 $\frac{1}{2}$ c each. How much change did she receive if she gave the clerk a quarter?

12. How much will be saved on 12 rides by buying street car tickets if the cash fare is 10 cents and the tickets sell for 8 $\frac{1}{3}$ c each?

13. Mrs. Smith bought 2 $\frac{1}{2}$ yards crepe satin at \$2.50 a yard and 3 yards muslin at 18 $\frac{1}{2}$ c a yard. What was the amount of her purchase?

14. What is the cost of 3 $\frac{1}{3}$ dozens eggs at 60 cents a dozen?

WRITTEN PROBLEMS

1. A farm containing 640 acres of land has 200 acres planted in corn, $\frac{1}{4}$ of the remainder in oats, $\frac{1}{3}$ of the remainder in barley, $\frac{2}{3}$ of the remainder in orchard, and the balance in pasture. What is the acreage of each?

2. The distance between Chicago and Waukegan by automobile is 40 miles, which is $\frac{2}{3}$ of the distance between Chicago and Milwaukee. What is the distance between Chicago and Milwaukee?

3. Wheat was quoted at the opening of the market on Monday at \$1.57; on Tuesday, \$1.57 $\frac{1}{2}$; on Wednesday, \$1.56 $\frac{3}{4}$; on Thursday, \$1.56 $\frac{1}{4}$; on Friday, \$1.55 $\frac{1}{2}$; on Saturday, \$1.55 $\frac{3}{4}$. What was the average quotation for the week?

4. A retail merchant buys beans at \$4.50 a hundred pounds. He sells them at three pounds for 25c. What is his gain (a) on a pound and (b) on a hundred pounds?

5. A dealer paid \$5.75 for a ton of coal (2,000 lbs.) and retailed it at 42 $\frac{1}{2}$ c a bushel (80 lbs.). What was his profit?

6. Three railroads carry goods a distance of 1,560 miles for \$7.50. If the distance covered by the first road is 780 miles; the second, 520 miles; and the remainder is covered by the third road, how was the charge of \$7.50 divided?

7. A lot is 50 $\frac{1}{4}$ feet wide by 80 $\frac{2}{3}$ feet deep. How many rods (16 $\frac{1}{2}$ ft. to a rod) of woven wire will be required to fence the lot?

8. I bought 25 turkeys for \$145.50. (a) If the average weight is 10 $\frac{1}{2}$ pounds, how much did I pay a pound? (b) If I desire a profit of $\frac{1}{3}$ of the cost, at what price a pound must I sell them?

9. A merchant bought a box of 120 apples at the rate of 3 for 5c. 18 were bruised and unfit for sale. He sold the others at the rate of 3 for 10c. What was his profit?

10. A stock of merchandise is marked $\frac{1}{4}$ above cost, but on account of damage by water is sold at $\frac{1}{3}$ of the marked price. If the loss is \$600, what was (a) the cost and (b) the selling price?

11. C. E. Herzog sold a lot fronting 62 $\frac{1}{2}$ feet on Main Street for \$1,718.75. How much did I. L. Campbell receive for the adjoining lot which has a frontage of 72 $\frac{1}{2}$ feet, if he sold it at the same price a front foot?

12. How much profit is made by purchasing 1,760 pounds of wool at $17\frac{1}{2}c$ a pound and by selling it at $32\frac{3}{8}c$ a pound after freight charges of $\$1.25\frac{1}{4}$ a hundred pounds are paid?

13. Johnson and Smith operated a bus line. The profit was shared in proportion to the investment. Johnson invested $\$2,750$ and Smith, $\$3,750$. During the month of June the profits were $\$128.50$. What part of this profit did each partner receive?

14. A book contained 416 pages. It was printed on paper 36 by 48 inches and 32 pages were printed on each side of a sheet. (a) How many pounds of paper would be needed to print 10,000 of these books if $\frac{1}{50}$ were allowed for waste and each ream of paper weighed 120 pounds and contained 500 sheets? (b) What would be the cost of the paper at $11\frac{1}{2}c$ a pound?

15. A boy saves one-fifth of his income each week and gives one-tenth of the remainder to charity. If his income is $\$25$ a week, (a) how much will he save each week; (b) how much will he give to charity in 12 weeks?

16. An automobile operated between Chicago and Elkhart consumed $6\frac{5}{8}$ gallons of gasoline at $22\frac{1}{2}c$ a gallon. (a) What did the gasoline for the trip cost? (b) If the distance was 100 miles, what was the average number of miles a gallon?

17. If you pay $20c$ for 3 pounds of potatoes, how much do you pay (a) for a bushel of 60 pounds; (b) for a peck?

18. Divide $\$90$ between two boys so that the first boy will have (a) $\frac{2}{3}$ as much as the second boy; (b) $\frac{2}{3}$ less than the second boy; and (c) $\frac{2}{3}$ more than the second boy.

19. Day, Marx, and Watts formed a partnership. Each partner was to share in the profits according to the amounts invested. Day invested $\$1,500$; Marx, $\$900$; Watts, $\$1,200$. After three months, the partners sold the business for $\$5,400$. Find how the sale price was divided among the partners in accordance with their agreement.

20. Andrews, Arnold, and Anderson rented a pasture for $\$48$ a month. Andrews had 6 cows; Arnold, 5 cows; and Anderson 8 cows. It was agreed that each would pay a portion of the rent based on the number of cows pastured. How much was each required to pay according to this agreement?

21. Four men are partners in the general merchandise business and gain the first year $\$6,250$. If they share the profits $\frac{2}{5}$, $\frac{1}{5}$, $\frac{1}{5}$, and $\frac{3}{10}$ respectively, how much will each get?

22. A man's liabilities are equal to $\frac{3}{4}$ of his assets. If his assets amount to \$48,000, what is his net worth?

23. A speculator gained $\frac{1}{20}$ on stock he sold at \$84. (a) Had he sold when it was quoted at \$90, what would have been his gain? (b) What would he have lost if he had sold at \$75?

24. A man speculated in grain and lost $\frac{1}{3}$ of his investment. The next year he gained \$600, and then had \$2,600. What was his original investment?

25. The sum of two numbers is $48\frac{1}{4}$. Their difference is $6\frac{3}{4}$. What is the product of the numbers?

26. A, B, C, and D invest \$1,200, \$1,500, \$2,500, and \$1,000 respectively. They are to share gains or losses in proportion to the capital invested. In the first year their profit is \$3,459.60. What will each receive?

27. A box of books weighed 384 pounds in gross. If the box weighed 36 pounds, what was the fractional weight of (a) the box and (b) its contents?

28. A boy rides a bicycle 7 miles in $\frac{3}{4}$ of an hour. At the same rate how long would it take him to ride $20\frac{3}{4}$ miles?

29. A merchant owned $\frac{3}{8}$ of a store and sold $\frac{1}{3}$ of his interest for \$6,000. What was (a) the total value of the store and (b) the value of his remaining interest?

30. A merchant asked $\frac{1}{2}$ more for an article than it cost. During a dull season he reduced the market price $\frac{1}{3}$. If he gained \$2.40, what was (a) the cost and (b) the selling price?

A THRIFT PROBLEM

James Murray earns \$200 a month. He has many varied expenses. In order to use his salary effectively and to save some of it regularly and systematically, he has set up the following budget arrangement: $\frac{1}{2}$ for household expenses; $\frac{1}{2}$ of the remainder for education, entertainment, clothing, and miscellaneous; $\frac{1}{2}$ of what is left for incidentals and emergency expenses; the remainder for savings and insurance. His insurance costs \$100 a year. How much does he save?

Can you solve this problem? What does one have to know before one can solve it? What do you think of James Murray's plan? Can you improve it in any way? How? Set up this plan in a more satisfactory budget arrangement.

UNIT 6

DECIMAL FRACTIONS

CHAPTER 24

ADDITION OF DECIMALS

A fractional value can be expressed decimally only when the denominator is 10 or a power of 10. The denominator of a decimal is determined by the position of the figures which express the value of the numerator and their relation to the decimal point.

The fractional value one-tenth, written as a common fraction, is $\frac{1}{10}$, and as a decimal fraction, .1; seven-tenths is $\frac{7}{10}$ or .7; twenty-seven hundredths is $\frac{27}{100}$ or .27; seven-hundredths is $\frac{7}{100}$ or .07. You will observe that when there is not a sufficient number of figures in the numerator to indicate the denominator, ciphers are placed between the decimal point and the figure or figures in the numerator. Thus, in writing the fractional value seven-hundredths as a decimal, it is necessary to place a cipher between the 7 and the decimal point; otherwise the value of the fraction would be seven-tenths. There must be as many figures at the right of the decimal point as there would be ciphers in the denominator if the fractional value were expressed as a common fraction.

EXERCISE No. 72, EXPRESSING FRACTIONS

The problems given below provide oral or written practice in expressing fractional values in both common and decimal fractions. As the fraction is read, you are to describe the method of writing it as both a common fraction and a decimal fraction.

NOTE: The word *and* in decimal fractions indicates a mixed decimal and denotes the decimal point; it connects the whole number and the decimal fraction. It is also used in reading a complex decimal.

1. Ninety-nine hundredths
2. One hundred seventy-five thousandths
3. One hundred and seventy-five thousandths
4. Sixteen ten-thousandths
5. Seven hundred fifty-five ten-thousandths

6. Seven and two-thirds of a thousandth
7. Seven and three and two-thirds thousandths
8. Thirty-one and thirteen hundredths
9. Seventy-seven hundred-thousandths
10. Two thousand and twenty-five ten-thousandths
11. Two hundred fifteen ten-thousandths
12. Three thousand seventy-five hundred-thousandths
13. Forty-four hundredths
14. Seventy-eight hundred-thousandths
15. Sixty-five ten-thousandths
16. Four hundred ten-thousandths
17. Five hundred sixty-five hundred-thousandths
18. Five hundred and one ten-thousandths
19. Seventeen thousandths
20. Five thousand five hundred fifty-five hundred-thousandths
21. Thirty-one thousandths
22. One hundred thousandths
23. Five hundred one ten-thousandths
24. Eighteen thousand three hundred forty-one hundred-thousandths
25. Thirteen ten-thousandths
26. One hundred and three thousand one hundred thirty-six ten-thousandths
27. One and sixteen thousandths

EXERCISE No. 73, CHANGING COMMON FRACTIONS TO DECIMALS

When a fractional value shown in common fraction form is to be expressed as a decimal fraction, it is necessary to reduce the fraction to its equivalent value in tenths, hundredths, thousandths, or the like. This reduction may be made (a) by multiplying the numerator and the denominator by a number which will cause the denominator to be expressed as tenths, hundredths, or thousandths, or (b) by dividing the numerator by the denominator. The illustration below shows the process of expressing the fractions $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{5}$, and $\frac{5}{8}$ in decimal form.

$$\frac{1}{2} \times \frac{5}{5} = \frac{5}{10} = .5$$

$$\frac{3}{4} \times \frac{25}{25} = \frac{75}{100} = .75$$

$$\frac{2}{5} \times \frac{2}{2} = \frac{4}{10} = .4$$

$$\frac{5}{8} \times \frac{125}{125} = \frac{625}{1000} = .625$$

To express the fraction $\frac{1}{2}$ as a decimal, it is necessary to secure a denominator of 10 or a power of 10. Since 2 is contained in 10 without a remainder, both the numerator and the denominator are multi-

plied by the quotient resulting from dividing 10 by 2. The value of the fraction will be expressed in tenths. This plan is followed in the illustration at the bottom of page 109. The fraction $\frac{6}{10}$ can be changed to decimal form by omitting the denominator and placing the decimal point at the left of the numerator.

The fraction $\frac{3}{4}$ cannot be expressed as tenths because 4 is not contained in 10 an even number of times. However, it can be expressed as hundredths since 4 is contained in 100, 25 times.

The fraction $\frac{2}{5}$ can be expressed as tenths because 5 is contained in 10, 2 times.

The fraction $\frac{3}{8}$ cannot be expressed as tenths or hundredths because 8 is not contained an even number of times in 10 or 100, but it is contained in 1,000 an even number of times.

The following problems provide practice in changing common fractions to decimal fractions by the process explained and illustrated above:

1.	2.	3.	4. ✓
a. $\frac{7}{25}$	a. $\frac{3}{4}$	a. $\frac{4}{25}$	✓ a. $\frac{4}{5}$
b. $\frac{27}{125}$	b. $\frac{15}{80}$	b. $\frac{9}{40}$	✓ b. $\frac{21}{100}$
c. $\frac{9}{50}$	c. $\frac{18}{25}$	c. $\frac{1}{5}$	✓ c. $\frac{63}{125}$
d. $\frac{5}{8}$	d. $\frac{17}{20}$	d. $\frac{11}{40}$	✓ d. $\frac{5}{16}$

EXERCISE No. 74, CHANGING DECIMALS TO COMMON FRACTIONS

When you desire to express the value of a decimal fraction as a common fraction, place the denominator indicated by the numerator under the numerator, and reduce the fraction to its lowest terms. Thus, .5 indicates the value five-tenths. This expressed as a common fraction is $\frac{5}{10}$, which reduced to its lowest term is $\frac{1}{2}$.

The following problems provide practice in expressing decimal fractions in the form of common fractions of equivalent value:

1.	2.	✓ 3.	4.
a. .55	a. .375	a. .36	a. .46
b. .82	b. .1875	b. .750	b. .09
c. .06	c. .0025	c. .3125	c. .07
d. .625	d. .4755	d. $.33\frac{1}{3}$	d. $.08\frac{1}{3}$
e. .45	e. .0125	e. $.12\frac{1}{2}$	e. .31

ADDITION OF DECIMAL FRACTIONS

When decimal fractions are to be added, the numbers are arranged so that units are under units, tens under tens, etc. The process of addition is, then, the same as that of whole numbers. The sum should be written as in whole numbers, the decimal point being kept in the same position in the sum as it is in the numbers added.

EXERCISE No. 75, ADDITION OF DECIMAL FRACTIONS

The following problems provide practice in the addition of fractional values expressed as decimal fractions. Show: (a) the sum of each column; (b) the sum of all the columns; and (c) the proof by reverse addition.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
.7	.3	.4975	.09	.9518	.723	.1824	.902
.16	.19	.5421	.7	.321	.12	.2071	.738
.395	.457	.9814	.625	.576	.519	.6925	.476
.9999	.3119	.7746	.8712	.743	.4897	.7298	.35
.2142	.5678	.2132	.3875	.9182	.7139	.5802	.4
.756	.245	.6539	.506	.8273	.4532	.9009	.712
.85	.37	.9001	.9	.123	.898	.3116	.29
.9	.5	.2078	.12	.4561	.424	.8195	.9916

EXERCISE No. 76, ADDITION OF DECIMAL FRACTIONS

In the following problems show: (a) the sum of each column; (b) the sum of all the columns; and (c) the proof by reverse addition.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
.769	.3	.3014	.509	.7568	.3225	.8	.2029
.131	.05	.3247	.1492	.3539	.5	.39	.0102
.8694	.225	.4639	.675	.209	.23	.009	.112
.37	.3579	.2001	.5559	.7	.4071	.881	.295
.4	.2468	.1918	.1263	.3215	.0003	.9532	.48
.0006	.875	.3575	.2198	.03	.913	.7581	.002
.3769	.19	.1827	.48	.9182	.429	.133	.21
.538	.37	.2112	.048	.6	.0005	.325	.301
.06	.7	.1444	.01	.3008	.192	.29	.221
.9	.9	.5053	.0001	.17	.02	.4	.848

EXERCISE No. 77, ADDITION OF MIXED DECIMALS

The process of the addition of mixed decimals is the same as that of the addition of decimals. The whole number is written at the left of the decimal point and the fraction at the right. The enumeration of the decimal is from left to right beginning with tenths, and the enumeration of the whole number is from right to left beginning with units.

The following problems provide practice in the addition of mixed decimals. Show: (a) the sum of each column; (b) the sum of all the columns; and (c) the proof by reverse addition.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
2098.1801	1598.09	9.8	1234.5678
5756.1982	7.75	13.21	356.102
9521.0019	918.625	625.505	27.01
1532.1492	1098.1444	1492.7981	3.3
1444.0509	509.7	1001.4332	7.8
7582.6257	37.67	509.111	31.67
1337.2118	112.111	21.75	999.107
3022.6029	1.0007	1.1	1776.1924

EXERCISE No. 78, CALLING MIXED DECIMALS

The following problems provide practice in calling and writing mixed decimals when the fractional values are expressed decimally. Find the sum of each problem and prove your result by reverse addition.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
3578.1329	721.001	1925.1926	21.98
821.098	9.1	1898.1001	666.625
43.11	85.48	7501.6145	3.7
6.9	2000.0002	3198.7152	21.0001
2.1	5243.8756	2000.1444	155.671
75.16	2978.3519	5053.2198	2198.1444
221.133	1795.2901	2222.1886	10.1

CHAPTER 25

SUBTRACTION OF DECIMALS

The process of subtraction in decimal fractions is the same as that in whole numbers. Since the position of the decimal always determines the value of the fraction, it is necessary to have the decimal points under one another before subtracting.

The illustrations below show the solution of .487 subtracted from .5, and .5 subtracted from .787.

The solution at the left shows the process of subtraction when three figures are required to express the fraction to be taken from one which can be expressed in one figure. The subtraction of 7 is from 10, 8 from 9, and 4

$\begin{array}{r} .5 \\ .487 \\ \hline .013 \end{array}$	$\begin{array}{r} \text{from 4, by the process of borrowing or by} \\ \text{adding to 7 the number which will make 10,} \\ \text{etc. Ciphers might be added to the right} \\ \text{of 5, but these are not necessary since they} \\ \text{may be assumed. In the process at the} \\ \text{right, the value of the fraction to be sub-} \\ \text{tracted is expressed in one figure, and the} \end{array}$	$\begin{array}{r} .787 \\ .5 \\ \hline .287 \end{array}$
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fraction from which it is to be subtracted, in three figures. Ciphers might be added to the right of the 5, but they are not necessary. The process is to bring down the figures in the thousandths and hundredths columns and to subtract the figures in the tenths column.

EXERCISE No. 79, SUBTRACTION OF DECIMAL FRACTIONS

The following problems provide practice in the subtraction of decimal fractions. Show the solution of each problem in the same form as that in the illustrations given above.

✓ 1	✓ 2	3	4	5
$\begin{array}{r} \checkmark a. .25 \\ .125 \\ \hline \end{array}$	$\begin{array}{r} \checkmark a. .2 \\ .0001 \\ \hline \end{array}$	$\begin{array}{r} a. .7 \\ .699 \\ \hline \end{array}$	$\begin{array}{r} a. .2 \\ .0221 \\ \hline \end{array}$	$\begin{array}{r} a. .14449 \\ .12315 \\ \hline \end{array}$
$\begin{array}{r} \checkmark b. .796 \\ .509 \\ \hline \end{array}$	$\begin{array}{r} \checkmark b. .5019 \\ .0201 \\ \hline \end{array}$	$\begin{array}{r} b. .001 \\ .0001 \\ \hline \end{array}$	$\begin{array}{r} b. .6374 \\ .3528 \\ \hline \end{array}$	$\begin{array}{r} b. .76852 \\ .49736 \\ \hline \end{array}$
$\begin{array}{r} \checkmark c. .7 \\ .235 \\ \hline \end{array}$	$\begin{array}{r} \checkmark c. .325 \\ .0475 \\ \hline \end{array}$	$\begin{array}{r} c. .9801 \\ .5766 \\ \hline \end{array}$	$\begin{array}{r} c. .0901 \\ .0176 \\ \hline \end{array}$	$\begin{array}{r} c. .21359 \\ .09078 \\ \hline \end{array}$

EXERCISE No. 80, SUBTRACTION OF MIXED DECIMALS

The process of subtracting mixed decimals is the same as that of subtracting decimal fractions. The decimal points must be placed in a vertical line, with the whole number values on the left, and the fractional values on the right, of the decimal points.

The following problems provide practice in subtracting mixed decimals:

1	2	3	4
a. 1000.0001 1.1 	a. 5138.7343 4917.9872 	a. 256.303 199.545 	a. 243.66 128.35
b. 2109.0098 143.7786 	b. 1774.1896 296.0041 	b. 405.001 31.786 	b. 267.89 165.01
c. 8778.1561 5489.3547 	c. 3149.9876 2214.7784 	c. 443.687 357.441 	c. 143.67 1.99

EXERCISE No. 81, SUBTRACTION OF MIXED NUMBERS

When one fractional value is expressed as a common fraction and the other as a decimal fraction, it is necessary, before subtracting, to express both values either as decimal fractions or as common fractions. The nature of the problem will determine whether it is better to change the decimal to a common fraction or the common fraction to a decimal.

The following problems provide practice in subtraction when both common and decimal fractions are involved. You will show all the calculations necessary to ascertain the answer and the proof of its correctness.

1	2	3
a. $\frac{3}{4} - .325$	a. $.9876 - \frac{9}{17}$	a. $24\frac{3}{8} - 18.244$
b. $\frac{9}{11} - .4465$	b. $.844 - \frac{9}{16}$	b. $63\frac{3}{8} - 52.4$
c. $\frac{7}{16} - .1716$	c. $.3444 - \frac{3}{41}$	c. $58.72\frac{1}{3} - 44.89\frac{4}{9}$
d. $\frac{1\frac{2}{5}}{2} - .007$	d. $.9 - \frac{9}{13}$	d. $75.5\frac{3}{7} - 67.987\frac{1}{3}$
e. $\frac{2\frac{1}{7}}{2} - .5$	e. $15\frac{3}{4} - 12.0055$	e. $4.567\frac{1}{2} - 2.999\frac{1}{3}$
f. $\frac{4}{5} - .125$	f. $36\frac{1}{3} - 24.97$	f. $28.093\frac{1}{3} - 25$

EXERCISE No. 82, REVIEW

The following problems provide a review of addition and subtraction of decimals. Show all the calculations necessary to arrive at the answer in each problem, and the proof of its correctness.

1. Add four and fifty-five ten-thousandths, seventy-five hundred-thousandths, one and sixteen hundredths, five thousand and one millionth.

2. From the sum obtained in Problem 1 take the sum of the following: sixteen ten-thousandths, one and nine hundred fifteen ten-thousandths, and seven-eighths of a hundred-thousandth.

3. Add 75 units, 75 tenths, 75 hundredths, 75 thousandths, and 75 ten-thousandths.

$$4. \frac{3}{4} + \frac{7}{8} + \frac{2}{3} + 1.6\frac{2}{3} + 10\frac{1}{4} + 37\frac{3}{8} + 1.9 + \frac{5}{8} + 12\frac{3}{16} + 2\frac{1}{8} = ?$$

5. Subtract $15.99\frac{1}{2}$ from 49.0016 .

6. From $77.4\frac{1}{2}$ take $65.87\frac{1}{8}$.

7. From $3.45\frac{2}{5}$ take $2.99\frac{3}{4}$.

8. How much greater is $\frac{1}{2}$ of a tenth than $\frac{2}{3}$ of a hundredth?

9. How much more is nine and three-fifths of a hundredth than six and two-fifths of a tenth?

10. From 300 take 3 hundredths.

11. What is the sum of $9.45 + .06\frac{2}{5} + 5.6 + 4.16\frac{3}{4} + 7.8\frac{1}{5}$?

12. Add $.24\frac{1}{5}$, $.1745\frac{3}{4}$, 46.5 , and 38.0007 .

13. $.3708 + \frac{1}{2} + 2.06\frac{2}{5} + \frac{3}{4} + .17\frac{3}{5} + .0\frac{1}{4} = ?$

14. $81.26\frac{1}{2} + .046\frac{1}{2} + 9.6\frac{2}{5} + 76.7895\frac{3}{4} = ?$

15. From $\frac{2}{5}$ of a tenth take $\frac{1}{2}$ of a hundredth.

16. To 19 hundredths add $\frac{2}{3}$ of a tenth.

17. What is the sum, in decimals, of $3\frac{1}{8}$, $1\frac{2}{5}$, $5\frac{1}{2}$, $2\frac{3}{4}$?

18. Subtract $16\frac{1}{2}$ tenths from 4,609 thousandths.

19. From $\frac{1}{18}$ of a hundredth take $\frac{5}{9}$ of a thousandth.

20. From $\frac{1}{3}$ of $\frac{1}{2}$ take $.0925$.

CHAPTER 26

PRACTICAL PROBLEMS

1. U. B. Joy bought six United States bonds at $102\frac{5}{8}$ and sold them at $103\frac{1}{4}$. (a) How much did he make on the transaction? (b) What fractional part of the cost is the profit? Express your answer decimally in hundred-thousandths. $102\frac{5}{8}$ means $\$102.62\frac{1}{2}$.

2. From three hundred forty-six and two hundred five ten-thousandths, take three hundred forty-six ten-thousandths.

3. The following problems provide practice in addition. Speed can be acquired only through combining figures as explained in Chapter 1. Find the sum of each problem and prove your answer.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
7,864,265	\$4,540.75	2.3	763.445	78,641
2,217,682	7,168.21	7.9	1.008	2,344,098
3,496,572	59.33	99.67	27.9	4,776
4,210,710	2,914.45	71.43	898.26	54,304
5,796,423	349.66	473.561	43.756	9,103,725
5,021,349	1,009.75	592.298	9.22	6,251,428
1,127,534	5.25	312.001	75.36	375
8,210,396	2,210.16	575.761	417.683	291,743
1,404,507	327.41	67.09	7.06	7,824,325
9,817,654	9,201.37	37.51	28.34	209,804
2,256,341	2,176.51	8.1	567.202	8,341,829
3,914,673	86.10	5.4	4.017	5,950,763

4. The following prices were quoted in a recent newspaper advertisement. You are to show: (a) the saving on each article; (b) the fractional value of this saving based on the original sale price expressed as a decimal fraction; and (c) the total saving to a customer who buys one each of these articles.

<i>a.</i> \$ 15.00 dresses	\$12.00	<i>d.</i> \$ 30.00 dresses	\$24.00
<i>b.</i> 20.00 dresses	15.00	<i>e.</i> 35.00 dresses	28.00
<i>c.</i> 25.00 dresses	20.00	<i>f.</i> 40.00 dresses	32.00

<i>g.</i>	\$ 48.00 dresses	\$36.00	<i>n.</i>	\$2.00 men's shirts	\$1.50
<i>h.</i>	60.00 dresses	40.00	<i>o.</i>	2.50 men's shirts	1.80
<i>i.</i>	100.00 dresses	70.00	<i>p.</i>	3.00 men's shirts	2.25
<i>j.</i>	125.00 dresses	90.00	<i>q.</i>	.40 towels	.35
<i>k.</i>	1.00 men's shirts	.80	<i>r.</i>	.48 towels	.40
<i>l.</i>	1.25 men's shirts	1.00	<i>s.</i>	.56 towels	.45
<i>m.</i>	1.50 men's shirts	1.20	<i>t.</i>	.75 towels	.60

5. The information given below shows the value of the building permits issued in certain Ohio cities during October and November of the same year and November of the previous year. You are to ascertain for each city: (a) the increase or the decrease in November of this year over October of this year; (b) the increase or the decrease in November of this year over November of last year; and (c) the increase or the decrease ascertained in (b), expressed decimally in thousandths.

	Nov. this Year	Oct. this Year	Nov. last Year
Akron	\$ 707,848	\$1,547,273	\$1,005,798
Cleveland	6,575,075	6,045,350	4,330,800
Columbus	1,233,800	3,240,700	1,368,500
Dayton	462,296	580,100	576,359
Hamilton	148,897	154,459	106,465
Lima	101,795	64,320	167,305
Mansfield	124,480	153,050	122,775
Springfield	78,560	78,055	354,350
Toledo	1,462,282	1,486,644	902,597
Youngstown	330,000	3,464,630	1,221,050

6. The following facts were published by Farm Paper No. 1 for the information of its advertisers and as evidence of its value as an advertising medium:

	Paper No. 1	Paper No. 2	Paper No. 3	Paper No. 4	Paper No. 5	Paper No. 6
	Lines	Lines	Lines	Lines	Lines	Lines
Farm machinery.....	9,194	3,277	2,475	1,551	806	783
Nursery stock, seeds, etc....	5,427	2,969	2,716	380	1,969	1,251
Poultry feeds and remedies..	4,496	2,312	2,128	1,239	1,012	860
Light and heating plants....	2,643	1,555	656	446	347	227

You are to ascertain: (a) the total number of lines of advertising in each of the six papers, and (b) the excess of the number of lines in Farm Paper No. 1 over those in each of the other five farm papers.

7. The table below shows the cost of operating the various departments of the United States Government for two consecutive years. You are to ascertain: (a) the total expenses for each year, (b) the increase of one year over the other year, and (c) the amount of this increase expressed decimally in ten-thousandths.

	1st Year	2d Year
Legislative establishment.....	\$ 14,915,001	\$ 16,498,384
Executive office.....	489,960	441,960
Independent Offices—		
Civil Service Commission.....	1,008,092	1,001,592
Employees' Compensation Commission.....	2,301,500	2,742,040
Federal Board of Vocational Education.....	8,227,000	8,210,620
Federal Trade Commission.....	1,008,000	997,000
General Accounting Office.....	3,701,960	3,714,400
Housing Corporation.....	743,915	674,398
Interstate Commerce Commission.....	6,853,962	6,033,309
Public Buildings and Public Parks.....	2,282,505	2,293,850
Tariff Commission.....	721,500	699,000
Shipping Board and Emergency Fleet.....	24,330,000	14,198,574
Smithsonian Institution and National Museum	874,020	858,240
United States Veterans' Bureau.....	405,700,000	458,965,000
Other independent offices.....	1,578,045	4,879,876
Department of Agriculture.....	133,075,191	140,717,758
Department of Commerce.....	28,542,129	30,402,847
Department of the Interior.....	262,255,603	250,967,602
Department of Justice.....	24,205,822	24,367,627
Department of Labor.....	8,627,625	8,567,305
Navy Department.....	302,862,378	322,869,430
State Department.....	16,277,652	16,614,932
Treasury Department.....	153,708,404	157,563,713
War Department, including Panama Canal...	339,765,931	335,641,525
District of Columbia.....	36,032,853	35,626,579

8. 37,500 pounds of potatoes cost \$521.25. Find the cost of a bushel and of a hundred pounds.

NOTE: A bushel of potatoes weighs 60 pounds.

9. A certain highway tunnel is 3,520 feet in length. The length is what part of a mile?

NOTE: A mile is 5,280 feet.

10. A dairy sells to a chain store its total production of milk of 135 gallons a day at 22c a gallon. This milk is bottled and sold at retail at 5c a pint. Find: (a) the amount paid the dairy for the daily supply of milk; (b) the profit made by the store on each pint; (c) the total profit on 135 gallons.

CHAPTER 27

MULTIPLICATION OF DECIMALS

The process of the multiplication of decimal fractions is the same as that of whole numbers. It is necessary, however, to take into consideration the fractional value of the product and to indicate this by having as many figures at the right of the decimal point as there are figures at the right of the decimal points in both the multiplier and the multiplicand.

$\begin{array}{r} .671 \\ .015 \\ \hline 3355 \\ 671 \\ \hline .010065 \end{array}$	The solution at the left shows the multiplication of two decimals which have the same denominator; and the one at the right, the multiplication of two decimals that have different denominators. You will observe the process of multiplication is the same as that when integers are multiplied, and there must be as many figures at the right of the decimal point as there are in both the multiplier and	$\begin{array}{r} .047 \\ .35 \\ \hline 235 \\ 141 \\ \hline .01645 \end{array}$
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the multiplicand. When there are not enough figures in the product, sufficient ciphers must be prefixed to make the decimal places the same.

EXERCISE No. 83, MULTIPLICATION OF DECIMALS

The following problems provide practice in the multiplication of decimal fractions. Show the solution of each problem in the same form as that in the illustration above, and prove by reverse multiplication. Each problem requires two solutions.

1	2	3
a. $.0725 \times .072$	a. $.3765 \times .012$	a. $.009965 \times .9$
b. $.0075 \times .005$	b. $.7564 \times .87$	b. $.009 \times .008$
c. $.2653 \times .325$	c. $.6562 \times .598$	c. $.2009 \times .675$
d. $.8642 \times .967$	d. $.0083 \times .7$	d. $.315 \times .18$

EXERCISE No. 84, MULTIPLICATION OF DECIMALS

In the following problems (a) write the amounts as decimals, (b) multiply, and (c) write each product in words.

1. Multiply six hundred seventy-five thousandths by seven hundredths.
2. Multiply seven thousand nine ten-thousandths by two thousandths.

- ✓ 3. Multiply three hundred twelve thousandths by fifty-seven hundredths.
4. Multiply sixty-seven hundredths by five thousandths.
- ✓ 5. Multiply four hundred fifty-four ten-thousandths by three hundred sixty-seven thousandths.
6. Multiply nine thousand nine hundred nine ten-thousandths by six ten-thousandths.
- ✓ 7. Multiply four hundred seventeen thousandths by twenty-nine hundredths.
8. Multiply one thousand four hundred forty-four ten-thousandths by five hundred nine thousandths.

EXERCISE No. 85, MULTIPLICATION OF INTEGERS AND DECIMALS

When a decimal fraction is to be multiplied by an integer, the process is the same as when two decimal fractions are multiplied.

The following problems provide practice in the multiplication of integers and decimals. Show all the calculations necessary (a) to ascertain the product, and (b) to prove the product by reverse multiplication.

1	2	3
a. $4981 \times .9009$	a. $3374 \times .1445$	a. $1742 \times .1492$
b. $762 \times .635$	b. $225 \times .13$	b. $1883 \times .005$
c. $3774 \times .1045$	c. $6725 \times .7631$	c. $4752 \times .367$
d. $7 \times .1673$	d. $3456 \times .33$	d. $298 \times .7$

EXERCISE No. 86, MULTIPLICATION OF MIXED DECIMALS

When an integer and a decimal are contained in both the multiplier and the multiplicand, the process of multiplication is the same as when decimals or a decimal and a whole number are multiplied. The following problems provide practice in multiplying mixed decimals. Show all the calculations necessary (a) to ascertain the product, and (b) to prove the product by reverse multiplication.

1	2	3
a. 9.887×100.6	✓ a. 763.25×2214.6	✓ a. 321.175×174.258
b. 35.42×625.8	b. 4356.2×329.43	b. 75.3908×214.432
c. 321.9×1.653	c. 55.424×1.2345	c. 625.107×4.00807
d. 277.3×14.25	d. 892.15×1007.1	d. 3675.42×275.314
e. 6.517×216.4	e. 56.432×1492.4	e. 1.00006×56.1472
f. 1.111×111.11	f. 1314.8×3.6	f. 36314.1×96.21
g. 313.1×8.136	g. 1912.6×11.83	g. 10009.2×83.161

CHAPTER 28

PRACTICAL PROBLEMS

1. The Mitchell Publishing Company, of Chicago, wishes to ship a quantity of books to San Francisco. Upon inquiry, the following rates are quoted: by rail directly from Chicago, as a carload, minimum weight 30,000 pounds, \$2.775 a hundred pounds; from Chicago to New York by rail, \$0.945 a hundred pounds, and from New York to San Francisco by water, \$0.90 a hundred pounds. You are to ascertain: (a) the freight cost on a carload of books weighing 36,487 pounds, shipped directly by rail; (b) the freight cost on the same shipment sent by rail and water; and (c) the amount saved if the shipment is made by rail and water and the marine insurance is \$42.

2. The distance between two cities is 477.68 miles. What is the cost of a railroad ticket at \$3.60 a hundred miles?

3. The freight rate on sugar shipped between two cities is 79.27 cents a hundred pounds. What will be the freight cost on five barrels weighing as follows: 327 pounds, 339 pounds, 325 pounds, 342 pounds, and 336 pounds?

4. (a) Find the cost of 50 pounds of coal at \$8.50 a ton of 2,000 pounds. (b) At what price a ton is coal sold if its price is 30c for 50 pounds?

5. A restaurant had two cakes of equal size. No. 1 was cut into 12 pieces and sold at 20c a piece, and No. 2 was cut into 18 pieces and sold at 15c a piece. You are to ascertain: (a) the fractional difference, expressed decimally, between the size of the pieces in the two cakes; (b) the difference between the selling prices of the two cakes; (c) the fractional relation, expressed decimally, of this difference as compared with the selling price of cake No. 1; and (d) the fractional relation of the difference as compared with the selling price of cake No. 2.

6. Find: (a) the value of each of the items listed on page 122, and (b) the total value.

- ✓ a. 125 lbs. at \$4 a hundred pounds
- b. 20 lbs. at \$0.035 a pound
- c. 450 lbs. at \$2.50 a hundred pounds
- d. 14 yds. at \$0.075 a yard
- e. 40 bu. at \$1.005 a bushel
- f. 4.5 tons at \$20 a ton
- g. 3,000 lbs. at \$8.25 a thousand pounds
- h. 15 gal. at \$0.425 a gallon
- i. 25 lbs. at \$0.025 a pound
- j. 2.5 bu. at \$2.50 a bushel

7. James Dobson, a traveling salesman, received $9\frac{3}{4}\%$ on each dollar and fraction thereof of sales which he made. In addition to that, he was reimbursed for his expenses in making the sales. During one year his sales were \$89,462.75 and his expenses, \$2,689.37. During that year his employers paid him \$5,600. How much was due him at the end of the year?

8. Three freight cars loaded with coal weighed respectively 29.75 tons, 42.285 tons, and 40.72 tons. What was (a) the total weight and (b) the total value at \$6.75 a ton?

✓ 9. The distance between Los Angeles and San Francisco is 475 miles. What is the cost of a railway ticket at \$.036 a mile?

✓ 10. Find: (a) the value of each of the following items and (b) the total value.

- a. 13 lbs. at \$0.755 a pound
- b. 139 lbs. at \$5 a hundred pounds
- c. 14 yds. at \$0.35 a foot
- d. 45.6 tons at \$18.555 a ton
- e. 7 qts. at \$0.195 a quart
- f. 19 ft. at \$1.165 a foot

CHAPTER 29

DIVISION OF DECIMALS

The process of the division of decimal fractions is the same as that of whole numbers. It is necessary, however, to take into consideration the fractional value of the quotient and to indicate this by having as many figures at the right of the decimal point as the number by which the decimal places in the dividend exceed those in the divisor. Thus, if the dividend has four figures at the right of the decimal point, and the divisor has one figure at the right of the decimal point, the quotient will have three figures at the right of the decimal point. When the decimal places in the divisor exceed those in the dividend, a sufficient number of ciphers should be annexed at the right of the decimal point in the dividend to make those in the dividend and the divisor equal. When all the figures or ciphers in the dividend have been used through the process of division, additional ciphers may be annexed at the right of the dividend, and the process of division continued; the figures in the quotient after the ciphers are annexed will be at the right of the decimal point.

The illustration given below shows the process of dividing .123 by .315 and .414 by .0375.

$ \begin{array}{r} .3904+ \\ \hline .315 \overline{) .1230000} \\ \underline{945} \\ 2850 \\ \underline{2835} \\ 1500 \\ \underline{1260} \\ 240 \end{array} $	The solution at the left shows the process of division with decimals which have the same denominator; the solution at the right, the division of two decimals which have different denominators. The quotient contains as many decimal places as the number by which the decimal places in the dividend exceed those in the divisor.	$ \begin{array}{r} 11.04 \\ \hline .0375 \overline{) .414000} \\ \underline{375} \\ 390 \\ \underline{375} \\ 1500 \\ \underline{1500} \end{array} $
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EXERCISE No. 87, DIVISION OF DECIMALS

The following problems provide practice in the division of decimal fractions. Show: (a) the quotient obtained in the same form as that illustrated above; (b) the proof of the quotient by

multiplication. If the division is not exact, annex ciphers to the dividend until three decimal places are obtained in the quotient.

1	2	3
✓a. $.3544 \div .22$	✓a. $.21 \div .0007$	a. $.26 \div .0076$
✓b. $.2096 \div .04$	✓b. $.45 \div .1312$	b. $.2245 \div .17$
c. $.7853 \div .37$	c. $.63 \div .0021$	c. $.42 \div .0006$
d. $.4598 \div .55$	d. $.75 \div .0025$	d. $.75 \div .0015$
e. $.2778 \div .03$	e. $.98 \div .7743$	e. $.2216 \div .14$
f. $.4935 \div .21$	f. $.64 \div .3124$	f. $.7308 \div .63$

EXERCISE No. 88, DIVISION OF DECIMALS

The following problems provide practice in: (a) expressing, with figures, fractional values in decimal form; (b) dividing one decimal by another; and (c) proving division by multiplication.

1. Twenty-six hundredths divided by forty-six thousandths.
2. Two thousand forty-four ten-thousandths divided by six hundred eight thousandths.
3. Five hundred eighty-six thousandths divided by forty-one hundredths.
4. Eight thousand nine hundred nine ten-thousandths divided by eight ten-thousandths.
5. Twenty-one hundredths divided by four hundred sixty-five thousandths.
6. Four hundred fifty-four ten-thousandths divided by sixty-five hundred-thousandths.
7. One hundred four millionths divided by three hundred thousandths.
8. Six hundred thirty-eight hundred-thousandths divided by sixty-five hundredths.
9. Six hundred twenty thousandths divided by forty-five ten-thousandths.
10. Three thousandths divided by twenty-seven ten-thousandths.

EXERCISE No. 89, DIVISION OF DECIMALS AND INTEGERS

The following problems provide practice in ascertaining the quotient resulting from the division of an integer by a decimal, or a decimal by an integer. Show: (a) all of your calculations, and (b) the proof of the quotient by multiplication. When the divisor is not contained in the dividend an equal number of

times, the process of division should be continued until three decimal places are obtained in the quotient.

1	2	3
a. $7642 \div .21$	a. $.6875 \div 43$	a. $.4756 \div 1137$
b. $5375 \div .55$	b. $.3413 \div 13$	b. $.5837 \div 21137$
c. $9847 \div .87$	c. $.8009 \div 11$	c. $.6847 \div 458$
d. $6845 \div .34$	d. $.2754 \div 21$	d. $.9283 \div 302$
e. $2098 \div .64$	e. $.9834 \div 67$	e. $.5738 \div 4573$
f. $4753 \div .49$	f. $.9672 \div 56$	f. $.7843 \div 6009$

EXERCISE No. 90, DIVISION OF MIXED DECIMALS

When the problem requires the division of one mixed decimal by another, or by an integer, or an integer by a mixed decimal, the process of division is the same as that of dividing a decimal fraction by a decimal fraction or by an integer.

The following problems provide practice in dividing mixed decimals. Arrange your work in the same form as that illustrated on page 123 and prove the quotients.

1	2	3
a. $77.54 \div 21.42$	a. $2781.4 \div 76.398$	a. $276.259 \div 139.117$
b. $2.980 \div 1.206$	b. $879.35 \div 396.67$	b. $9876.54 \div 25.7643$
c. $355.6 \div 121.9$	c. $43.006 \div 2.5467$	c. $42.7108 \div 7.64371$
d. $98.75 \div 567.3$	d. $778.24 \div 221.16$	d. $554.872 \div 23.1581$
e. $443.7 \div 5.432$	e. $9876.5 \div 33.489$	e. $3724.05 \div 221.786$
f. $0.009 \div 3.508$	f. $67.309 \div 9.3274$	f. $629.405 \div 321.456$

EXERCISE No. 91, DIVISION OF MIXED DECIMALS

The following problems provide practice in dividing a mixed decimal by an integer and an integer by a mixed decimal. Arrange your work in the same form as that illustrated on page 123 and prove the quotients.

1	2	3
✓ a. $13.487 \div 367$	✓ a. $4877 \div 25.574$	✓ a. $643.14 \div 48374$
b. $134.57 \div 32$	b. $5869 \div 234.67$	b. $374656 \div 23.46$
c. $1283.6 \div 845$	c. $5948 \div 4351.6$	c. $23.473 \div 47362$
d. $1.3785 \div 1389$	d. $3945 \div 2.3875$	d. $548.23 \div 47321$
e. $14.675 \div 147$	e. $1374 \div 23.463$	e. $485712 \div 2.374$
f. $123.75 \div 168$	f. $2137 \div 574.46$	f. $584731 \div 34.54$

CHAPTER 30

PRACTICAL PROBLEMS

The purpose of these problems is to provide additional practice in applying the four fundamental operations to problems involving decimal fractions and in using fractions in the solution of business problems. You are to show: (a) all calculations necessary to ascertain the desired facts; and (b) the proof of your calculations.

1. At the beginning of a ten-day vacation trip, the speedometer on J. F. Sherwood's car registered 9,647.8 miles. The mileage registered at the close of each of the ten days was as follows: 9,935.4; 10,191.8; 10,487.1; 10,792.8; 11,105.4; 11,401.9; 11,714.4; 11,989.7; 12,242.6; and 12,512.1. You are to ascertain: (a) the distance traveled each day; (b) the total distance traveled; and (c) the average mileage each day.

2. During the ten-day vacation trip mentioned in Problem 1, Mr. Sherwood purchased gasoline as follows: first day, 15 gals. at $22\frac{1}{2}c$ and 15 gals. at $23c$; second day, 15 gals. at $24\frac{1}{2}c$; third day, 15 gals. at $22c$ and 15 gals. at $22\frac{1}{2}c$; fourth day, 15 gals. at $23c$ and 15 gals. at $23\frac{1}{2}c$; fifth day, 15 gals. at $23\frac{1}{2}c$ and 15 gals. at $22\frac{1}{2}c$; sixth day, 15 gals. at $22\frac{1}{2}c$ and 15 gals. at $21\frac{1}{2}c$; seventh day, 15 gals. at $24c$; eighth day, 15 gals. at $23c$ and 15 gals. at $22\frac{1}{2}c$; ninth day, 15 gals. at $22\frac{1}{2}c$ and 15 gals. at $22c$; tenth day, 15 gals. at $22\frac{1}{2}c$ and 15 gals. at $22c$. You are to ascertain: (a) the cost of the gasoline used on the trip; (b) the number of miles obtained from each gallon (expressing the answer decimally in thousandths).

3. A ton (2,000 pounds) of ground feed contains 200 pounds of flaxseed, 250 pounds of corn, and 750 pounds of barley. The remainder is oats. Express the fractional part of each in decimal form.

4. The cost of manufacturing an order for 5,240 knives was \$642.58. What was the cost of a knife in cents and thousandths of a cent?

✓ 5. The cost of manufacturing 6,500 spools was \$4.29. What was the cost of a spool?

6. The passenger fare from Cincinnati to Chicago is \$14.01. The rate is \$0.036 a mile. You are to ascertain the distance between these two cities, expressed as a whole number or as a mixed number with the fraction expressed decimally in hundredths.

7. The space occupied by each department of a factory was as follows:

Department A.....	4,700 square feet
Department B.....	6,100 square feet
Department C.....	8,300 square feet
Department D.....	9,500 square feet
Department E.....	4,600 square feet
Department F.....	5,800 square feet

The annual rent was \$7,200. You are to ascertain: (a) the amount of annual rent allocated to each department; (b) the amount charged to each department when the rent was paid on the first of each month.

✓ 8. C. M. Orr paid \$60,000 for an eight-apartment building. His net income from the rent of this building at the end of the first year was .092 of the cost of the property. (a) How much was the net income? (b) What was the net monthly rent for each of the eight apartments?

9. A certain automobile company advertised that one of its models was driven from Washington, D. C., to Oakland, California, 3,127 miles, in 96 hours and 18 minutes. What was the average number of miles traveled each hour?

NOTE: Your answer should be shown as a mixed decimal with the fraction expressed in thousandths.

10. The present standing of the Champion Baseball Club is .875; that of the Challengers, .625. At the present time each club has played 48 games. If the Champions win only 4 of the next 12 games, and the Challengers win 8 of the next 12 games, how will the clubs stand?

11. If sugar sells at .075 a pound, how many pounds can you buy for \$75.75?

✓ 12. Corn meal is advertised at a special sale at 12.25 pounds for 62c. What is the cost of a pound?

13. A publishing company sold the following books during the year: January, 926; February, 842; March, 530; April, 285; May, 248; June, 196; July, 495; August, 1,548; September, 5,490; October, 4,560; November, 1,249; December, 539. Ascertain: (a) the total number of books sold during the year; (b) the average number sold monthly; and (c) the number sold each month, which is above or below the average, indicating sales above the average by "+", and below by "-".

14. L. B. Reid purchased five \$1,000 bonds of the Inland Steel Company for $97\frac{3}{4}$ and sold them for $99\frac{3}{8}$. You are to ascertain: (a) the total amount paid for the bonds; (b) the amount received for them; (c) the profit; and (d) the profit expressed decimally in thousandths.

NOTE: $97\frac{3}{4}$ means \$97 $\frac{3}{4}$ on each \$100 of the bond or \$977.50 for each bond.

15. L. A. Long gained \$130 on an investment of \$2,000. What fractional part of the investment did he gain?

16. A store has five departments occupying 5,460, 4,789, 6,732, 5,931, and 7,750 square feet. The annual rent is \$18,000. Find: (a) the amount of annual rent charged to each department; (b) the monthly rent charged to each department.

17. If coffee costs 83c for two pounds, how many pounds can you buy for \$13.28?

CHAPTER 31

BUSINESS PRACTICE

1. James Brown purchased an automobile on the deferred-payment plan. The cost price of the automobile was \$1,680; the cost of the insurance, \$44; and that of the extras, \$120. He is to pay cash for the insurance and the extras, and is to pay four-tenths of the cost price of the automobile. The balance of the cost, plus the carrying charge of \$180, is to be paid in twelve equal monthly installments. You are to ascertain: (a) the amount of cash paid at the time of the purchase; (b) the amount of each monthly payment; and (c) the total cost of the automobile when the twelve installments have been paid.

2. After using the automobile mentioned in Problem 1 for two years, Mr. Brown exchanged it for a new one and was allowed an exchange value of \$750. You are to ascertain: (a) the decrease in the value of the old machine; and (b) the average monthly decrease in value.

Billing. The multiplication of integers and of fractions expressed decimally occurs frequently in making extensions on bills. It is not always possible to express by integers the quantity of merchandise sold and the price. The following problems provide practice in making extensions when the fractional values are expressed as decimals.

3. Brown Brothers, provision merchants, Buffalo, New York, sold J. C. Warren the following provisions:

20 Bacon Sides, 421 lbs.	@ \$.1375 a lb.
25 Hams, 395½ lbs.	@ .225 a lb.
50 cans Lard, 2,500 lbs.	@ .2175 a lb.
5 sacks Dried Apples, 385 lbs.	@ .145 a lb.

4. The American Sugar Company sold the following items to J. B. Lipscomb, a retail grocer, on November 17:

5 bbls. Granulated Sugar, 1,642 lbs.	@	\$6.35 a cwt.
3 bbls. Brown Sugar, 917 lbs.	@	5.95 a cwt.
25 100-lb. bags Granulated Sugar	@	7.05 a cwt.
25 50-lb. bags Granulated Sugar	@	7.07 a cwt.
10 25-lb. sacks Granulated Sugar	@	7.09 a cwt.
200 boxes Domino Sugar	@	.23 a box
50 boxes Powdered Sugar	@	.27 a box

5. The Hale Justis Wholesale Drug Company sold the following items to The Corner Drug Store on June 6:

6 doz. boxes Aspirin	@	\$1.41 a doz.
5 doz. bottles Witch Hazel	@	2.30 a doz.
36 boxes Talcum Powder	@	.18 a box
20 jars Vaseline	@	.11 $\frac{3}{4}$ a jar
8 doz. boxes Zinc Stearate	@	1.80 a doz.
24 bottles Rubbing Alcohol	@	.52 $\frac{1}{2}$ a bottle

6. The Norwood Beauty Shop sold the following items to Mary Janson:

1 jar Specialty Cream	@	\$1.15 a jar
3 boxes Talcum Powder	@	.45 a box
5 boxes Face Powder	@	.98 a box
2 bottles Hand Lotion	@	1.50 a bottle
9 bottles Brilliantine	@	.55 a bottle

7. The School Book Supply Co. sold the Newbrook Twp. School District the following items:

100 doz. Pencils	@ \$	.02 a pencil
60 Writing Tablets	@	.09 a tablet
1 gross Pencils	@	.03 a pencil
75 Textbooks	@	1.68 a book
62 Work Books	@	3.60 a doz.

CHAPTER 32

ALiquot PARTS

An integer or a mixed number which is contained in another number without a remainder is known as an *aliquot part* of that number. 3 is an aliquot part of 6, because it is contained in 6 without a remainder. $2\frac{1}{2}$ is an aliquot part of 5, because it is contained in 5 without a remainder.

The aliquot parts of 100 may be used to advantage in the multiplication of numbers when dollars and cents are involved. Thus, if the price of an article is $16\frac{2}{3}$ c and the number of articles involved is 63, the value of the 63 articles can be ascertained by multiplying 63 by $16\frac{2}{3}$ c or dividing 63 by 6. The solutions below show the application of both methods.

The solution at the left shows the process	
63	when multiplication is used. The first
<u>.16$\frac{2}{3}$</u>	amount in the solution, 42, is the product
42	$\frac{2}{3} \times 63$; the second amount is 6×63 ; and
378	the third amount is 1×63 . Two places
63	are pointed off in the product because of
	the two decimal places in the multiplier.
<u>\$10.50</u>	The solution at the right shows the
	process when 63 is divided by 6. Six is
	contained in 63 ten times with a remainder
	of 3; in 30, five times with no remainder.

$$\begin{array}{r} 6)63.00 \\ \hline \$10.50 \end{array}$$

Hence, the result of dividing 63 by 6 is ten and fifty hundredths, or \$10.50.

The process of reasoning when aliquot parts are applied to the solution of this problem is as follows: If the price is $16\frac{2}{3}$ c for one article, 6 articles can be purchased for \$1 because $16\frac{2}{3}$ is $\frac{1}{6}$ of a dollar; if the price of each article were a dollar, the total cost of 63 articles would be \$63, but since the price is only $\frac{1}{6}$ of a dollar, the total cost is $\frac{1}{6}$ of \$63, or \$10.50.

EXERCISE No. 92, ALIQUOT PARTS

The problems on page 132 provide practice in ascertaining the value of a given number of articles when the price is an aliquot part of a dollar. The aliquot parts of a dollar most frequently used are shown in the second column of the table on page 133.

1

- a. 9 bu. oats at $33\frac{1}{3}c$
 b. 24 #* sugar at $6\frac{1}{4}c$
 c. 120 # candy at $16\frac{2}{3}c$
 d. 32 # lard at $12\frac{1}{2}c$
 e. 22 # tea at 50c
 f. 24 doz. eggs at 50c
 g. 32 yds. ribbon at $33\frac{1}{3}c$
 h. 45 # bacon at $12\frac{1}{2}c$
 i. 84 # butter at $33\frac{1}{3}c$
 j. 75 gals. oil at $16\frac{2}{3}c$
 k. 720 # bacon at 25c
 l. 96 # sugar at 10c

2

- a. 48 # apples at $8\frac{1}{3}c$
 b. 56 # beans at $12\frac{1}{2}c$
 c. 60 doz. eggs at $33\frac{1}{3}c$
 d. 96 doz. eggs at $33\frac{1}{3}c$
 e. 48 yds. cloth at $12\frac{1}{2}c$
 f. 84 # sugar at $8\frac{1}{3}c$
 g. 720 yds. ribbon at 25c
 h. 75 gals. oil at 20c
 i. 114 # soap at $16\frac{2}{3}c$
 j. 15 gals. gas at $33\frac{1}{3}c$
 k. 55 # lard at 20c
 l. 60 gals. cider at 50c

*NOTE: When the symbol # is placed after figures, it is interpreted as *pounds*; when placed before figures, it is interpreted as *number*.

EXERCISE No. 93, ALIQUOT PARTS

If the quantity is an aliquot part of 100, or the price is an aliquot part of a dollar, the process of division may be applied in the same way. Thus, the cost of 50 pounds at 27c a pound would be 27 divided by 2, or \$13.50, just as the cost of 27 pounds at 50c would be \$13.50.

The following problems provide practice in aliquot parts, when the price is an aliquot part of a dollar or the quantity is an aliquot part of 100.

1

- a. 25 gals. at 28c
 b. 28 gals. at 25c
 c. $33\frac{1}{3}$ # at 18c
 d. 96 # at $8\frac{1}{3}c$
 e. 75 hrs. at 50c
 f. 39 yds. at $33\frac{1}{3}c$
 g. 66 yds. at $12\frac{1}{2}c$
 h. 25 gals. at 42c

2

- a. 42 gals. at 25c
 b. 56 # at $12\frac{1}{2}c$
 c. $12\frac{1}{2}$ hrs. at \$1.20
 d. 50 hrs. at \$1.20
 e. 36 gals. at $33\frac{1}{3}c$
 f. 99 # at $16\frac{2}{3}c$
 g. 59 bu. at 50c
 h. 50 gals. at 44c

3

- a. 28 doz. at $33\frac{1}{3}c$
 b. $12\frac{1}{2}$ doz. at 28c
 c. 42 yds. at 20c
 d. 20 yds. at 45c
 e. 51 bu. at $33\frac{1}{3}c$
 f. 25 gals. at 80c
 g. 81 # at $16\frac{2}{3}c$
 h. 64 # at $33\frac{1}{3}c$

TABLE OF ALIUOT PARTS

\$1.00	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	.50														
3	.33 $\frac{1}{3}$	.66 $\frac{2}{3}$													
4	.25	.50	.75												
5	.20	.40	.60	.80											
6	.16 $\frac{2}{3}$	.33 $\frac{1}{3}$	.50	.66 $\frac{2}{3}$	.83 $\frac{1}{3}$										
8	.12 $\frac{1}{2}$	.25	.37 $\frac{1}{2}$	.50	.62 $\frac{1}{2}$	.75	.87 $\frac{1}{2}$								
10	.10	.20	.30	.40	.50	.60	.70	.80	.90						
12	.08 $\frac{2}{3}$	.16 $\frac{1}{3}$	.25	.33 $\frac{1}{3}$	.41 $\frac{2}{3}$	.50	.58 $\frac{1}{3}$	.66 $\frac{2}{3}$	.75	.83 $\frac{1}{3}$	.91 $\frac{2}{3}$				
16	.06 $\frac{1}{4}$	.12 $\frac{1}{2}$	.18 $\frac{3}{4}$	.25	.31 $\frac{1}{4}$	.37 $\frac{1}{2}$	.43 $\frac{3}{4}$	.50	.56 $\frac{1}{4}$	.62 $\frac{1}{2}$	.68 $\frac{3}{4}$	.75	.81 $\frac{1}{4}$	.87 $\frac{1}{2}$	.93 $\frac{3}{4}$

The table above shows the aliquot parts of a dollar and of 100, and the multiples of these aliquot parts. The numbers in the first vertical column indicate the denominators of the fractions representing the aliquot parts of a dollar; and the numbers at the top in the horizontal column, the numerators of the fractions representing the multiples of these aliquot parts. The aliquot parts of a dollar or of 100 are shown in the squares where the two columns meet. 50c is $\frac{1}{2}$ of a dollar; 33 $\frac{1}{3}$ c is $\frac{1}{3}$ of a dollar. 66 $\frac{2}{3}$ c is twice 33 $\frac{1}{3}$ c; hence, it is a multiple of the aliquot part, 33 $\frac{1}{3}$ c. 25c is $\frac{1}{4}$ of a dollar, and 50c and 75c are both multiples of 25c. 20c is an aliquot part of a dollar, and 40c, 60c, and 80c are multiples of this aliquot part.

EXERCISE No. 94, MULTIPLES OF ALIUOT PARTS

When the price of an article is a multiple of an aliquot part, the value of a given number of articles is ascertained by dividing the quantity by the denominator of the fraction representing the aliquot part, and by multiplying the quotient by the numerator of the fraction representing the multiple of the aliquot part. If the quantity is an aliquot part of 100, the same principle will apply in ascertaining the price of the articles.

If it is desired to ascertain the value of 48 articles at 37 $\frac{1}{2}$ c each, divide 48 by 8 and multiply by 3: $48 \div 8 = 6$; $6 \times 3 = 18$. When the aliquot part is of \$1.00, this product, 18, is \$18.00.

The problems at the top of page 134 provide practice in applying the information given in the table. The results are the same whether you divide and multiply, or multiply and divide.

1	2	3
a. 48 bu. at 75c	a. 48 gals. at $41\frac{2}{3}$ c	a. 50 gals. at 75c
b. 32 lbs. at $62\frac{1}{2}$ c	b. 54 bu. at $83\frac{1}{3}$ c	b. 98 doz. at $37\frac{1}{2}$ c
c. 96 bu. at $91\frac{2}{3}$ c	c. 85 yds. at 40c	c. 96 gals. at $18\frac{3}{4}$ c
d. 64 gals. at $87\frac{1}{2}$ c	d. 50 bu. at 65c	d. 66 gals. at $41\frac{2}{3}$ c
e. 45 yds. at 80c	e. 75 gals. at 24c	e. 88 gals. at $87\frac{1}{2}$ c
f. 128 lbs. at $81\frac{1}{4}$ c	f. $83\frac{1}{3}$ yds. at 48c	f. 105 lbs. at 60c
g. 55 gals. at 40c	g. 96 bu. at $91\frac{2}{3}$ c	g. 75 lbs. at 25c
h. 72 bu. at 75c	h. 45 yds. at 40c	h. 25 gals. at 50c

EXERCISE No. 95, MULTIPLES OF ALIQUOT PARTS

The following problems provide practice in applying multiples of aliquot parts. Show: (a) the value of the one aliquot part by division; (b) the value of the required multiple by multiplication. Refer to the table and find the multiple as instructed. When the divisor is not contained an equal number of times, first multiply and then divide the product.

1	2	3
a. 376 yds. at 75c	a. 516.8# at $62\frac{1}{2}$ c	a. 16.25 bu. at $87\frac{1}{2}$ c
b. 529 gals. at $18\frac{3}{4}$ c	b. 6,875# at 25c	b. 481 yds. at $31\frac{1}{4}$ c
c. 756 gals. at $83\frac{1}{3}$ c	c. 91.6 bu. at $68\frac{3}{4}$ c	c. 2,265.75gals. at $83\frac{1}{3}$ c
d. 1,236# at 30c	d. 9,672.75# at $18\frac{3}{4}$ c	d. 15.75 bu. at $93\frac{3}{4}$ c
e. 3,264 bu. at $43\frac{3}{4}$ c	e. 762.5 doz. at $83\frac{1}{3}$ c	e. 742.5 doz. at $37\frac{1}{2}$ c
f. 9,782.5# at $31\frac{1}{4}$ c	f. 275.5 doz. at $31\frac{1}{4}$ c	f. $37\frac{1}{2}$ doz. at 42c
g. 421.75# at 40c	g. 762 bu. at 75c	g. $62\frac{1}{2}$ bu. at 97c
h. 99.6 bu. at $56\frac{1}{4}$ c	h. 9,964.75# at $91\frac{2}{3}$ c	h. $81\frac{1}{4}$ gals. at 23c

EXERCISE No. 96, MULTIPLES OF ALIQUOT PARTS

When the price is more than \$1.00, or the quantity more than 100, and the excess of \$1.00 or 100 is an aliquot part or a multiple of an aliquot part, the product may be found by dividing and multiplying in the same manner as when the price or the quantity is less than \$1.00 or 100. Thus, if the price is $\$1.37\frac{1}{2}$, divide the quantity by 8, and multiply by 3 plus 8, or 11. In other words, the price is $\frac{8}{8}$ of a dollar plus $\frac{3}{8}$ of a dollar.

The following problems provide written practice in applying aliquot parts, and multiples of aliquot parts.

1

- a. 7,261 lbs. at \$1.33 $\frac{1}{3}$
- b. 127 $\frac{1}{2}$ bu. at \$1.12 $\frac{1}{2}$
- c. 81.25 lbs. at 32c
- d. 45 doz. at \$1.87 $\frac{1}{2}$
- e. 227 $\frac{1}{2}$ bu. at \$1.62 $\frac{1}{2}$
- f. 387 $\frac{1}{2}$ lbs. at 18 $\frac{3}{4}$ c
- g. 75 $\frac{3}{4}$ doz. at \$1.75
- h. 427.05 bu. at \$1.30
- i. 55.25 gals. at 58 $\frac{1}{2}$ c
- j. 216.5 bu. at \$1.41 $\frac{2}{3}$

2

- a. 768 bu. at \$1.12 $\frac{1}{2}$
- b. 22.05 gals. at \$1.37 $\frac{1}{2}$
- c. 214 $\frac{1}{2}$ lbs. at 18 $\frac{3}{4}$ c
- d. 516.75 bu. at \$1.16 $\frac{2}{3}$
- e. 271.5 bu. at 87 $\frac{1}{2}$ c
- f. 621.25 lbs. at \$1.08 $\frac{1}{3}$
- g. 217.5 bu. at \$1.06 $\frac{1}{4}$
- h. 79 gals. at \$1.83 $\frac{1}{3}$
- i. 177 $\frac{1}{2}$ doz. at 43 $\frac{3}{4}$ c
- j. 991 bu. at \$1.06 $\frac{1}{4}$

APPLICATION OF ALIQUOT PARTS

Corn, wheat, and other grain are listed on the grain exchanges at the price by the bushel; but when delivered, the quantity is usually expressed in pounds, because it is not possible to provide containers holding an even number of bushels. When the price is by the bushel, and the quantity is expressed in pounds, there are three methods of ascertaining the value of a given quantity: (a) by dividing the quantity by the number of pounds in a bushel, and multiplying by the price of a bushel; (b) by multiplying the number of pounds by the price of a bushel, and dividing by the number of pounds in a bushel; and (c) by multiplying the number of pounds by a fraction in which the numerator is the price of a bushel and the denominator is the number of pounds in a bushel. The illustrations below show the three methods of ascertaining the value of 4,704 pounds of corn at 72c a bushel of 56 pounds.

$$\begin{array}{lll}
 a. 4704 \div 56 = 84 & b. 4704 \times \$.72 = \$3386.88 & c. \frac{72}{56} = \frac{9}{7} \\
 84 \times \$.72 = \$60.48 & \$3386.88 \div 56 = \$60.48 & 672 \\
 & & \cancel{4704} \times \frac{9}{7} = \$60.48
 \end{array}$$

In the problem given, the quantity can be expressed as an even number of bushels; hence, solution (a) would be the most satisfactory. If the number of pounds had not been an even number of bushels, the fraction would have made the calculations more complicated. In solution (b) it is assumed that

the price is that of a pound; hence, the total number of pounds is multiplied by the price. Then the product is divided by 56, the number of pounds in a bushel. In solution (c) the price of a bushel is used as the numerator of a fraction, the denominator of which is the number of pounds in a bushel. This fraction is reduced to its lowest terms. Solution (c) is the most satisfactory when the price and the number of pounds have factors in common, and the fraction may, therefore, be reduced to lower terms.

EXERCISE No. 97, APPLICATION OF ALIQUOT PARTS

The problems given below provide practice in ascertaining the value of corn by using the methods explained above. Using one of the three methods illustrated, show all the calculations necessary to ascertain the value of the given quantity at the price stated in each instance. The figures in the first column indicate the number of pounds of corn purchased; the amount in the second column is the price of a bushel of 56 pounds.

1	2
a. 5,159# at \$.64 a bu.	a. 84,000# at \$.84 a bu.
b. 2,144# " .63 " "	b. 91,562# " 1.05 " "
c. 5,004# " .84 " "	c. 17,642# " 1.12 " "
d. 1,008# " .49 " "	d. 11,200# " .88 " "
e. 9,884# " .48 " "	e. 98,000# " .91 " "
f. 8,010# " .76 " "	f. 28,000# " .84 " "
g. 4,800# " .77 " "	g. 72,568# " .56 " "
h. 5,901# " .88 " "	h. 66,480# " .77 " "
i. 5,146# " .56 " "	i. 56,700# " .70 " "
j. 3,988# " .98 " "	j. 98,000# " 1.05 " "
k. 2,295# " .51 " "	k. 13,192# " .98 " "
l. 4,937# " .59 " "	l. 14,536# " .72 " "
m. 3,036# " .62 " "	m. 76,400# " 1.03 " "
n. 3,920# " .54 " "	n. 76,680# " .75 " "
o. 3,136# " .72 " "	o. 56,000# " .84 " "

EXERCISE No. 98, APPLICATION OF ALIQUOT PARTS

The following problems provide practice in ascertaining the value of wheat when the price is that of a bushel of 60 pounds.

1	2
a. 6,475# at \$.66 a bu.	a. 98,576# at \$.90 a bu.
b. 3,781# " .60 " "	b. 17,645# " 1.08 " "
c. 5,650# " .63 " "	c. 86,664# " .75 " "
d. 9,864# " .65 " "	d. 56,878# " 1.50 " "
e. 7,500# " .51 " "	e. 24,000# " 1.10 " "
f. 2,400# " .96 " "	f. 99,960# " 1.26 " "
g. 9,996# " 1.25 " "	g. 20,000# " 1.05 " "
h. 7,884# " 1.10 " "	h. 72,000# " 1.32 " "
i. 9,964# " 1.05 " "	i. 11,164# " 1.10 " "
j. 7,765# " .96 " "	j. 67,566# " 1.35 " "

EXERCISE No. 99, APPLICATION OF ALIUOT PARTS

When the quantity is stated in pounds, and the price of a bushel is a multiple of an aliquot part of the number of pounds in a bushel, the value can be ascertained by multiplying the number of pounds by the fraction representing this multiple.

Thus, the cost of 862 pounds of oats at 48c a bushel of 32 pounds would be figured as follows: $862 \times \frac{48}{32} = 862 \times \frac{3}{2} = \frac{2586}{2} = \12.93 . Since a bushel of oats weighs 32 pounds, one-half of a bushel is 16 pounds. 16 is an aliquot part of 32 and also of 48.

The following problems provide practice in the use of multiples of aliquot parts in ascertaining the value of oats sold at 32 pounds to a bushel. The quantity is given in the first column, and the price of a bushel, in the second column.

1	2
a. 7,846# at \$.80 a bu.	a. 74,000# at \$1.12 a bu.
b. 2,568# " .36 " "	b. 96,468# " 1.04 " "
c. 3,894# " .48 " "	c. 20,468# " .64 " "
d. 8,760# " .64 " "	d. 11,676# " .88 " "
e. 7,400# " .40 " "	e. 29,684# " 1.32 " "
f. 2,696# " .56 " "	f. 67,856# " .68 " "
g. 9,896# " .68 " "	g. 39,568# " 1.00 " "
h. 5,672# " 1.04 " "	h. 87,652# " .72 " "
i. 3,784# " .48 " "	i. 54,800# " .36 " "
j. 6,392# " 72 " "	j. 20,000# " .56 " "

NOTE: The aliquot parts of a bushel, used to the best advantage, are: 4 lbs. = $\frac{1}{8}$; 8 lbs. = $\frac{1}{4}$; 16 lbs. = $\frac{1}{2}$.

EXERCISE No. 100, APPLICATION OF ALIQUOT PARTS

Logs are sawed into lumber in pieces with the desired length, width, and thickness, and are sold at the price of a thousand board feet. When the quantity or the price is an aliquot part, or a multiple of an aliquot part, of a thousand board feet, the price may be ascertained by multiplying by a fraction. The process is the same as that used in figuring the value of grain. Thus, the value of 750 feet of lumber at \$36 a thousand board feet may be ascertained by using 750 as the numerator of a fraction and 1,000 as the denominator. This fraction reduced to its lowest terms is $\frac{3}{4}$. The price of a thousand board feet, \$36, is then multiplied by $\frac{3}{4}$. The product of \$27 is the price of 750 feet.

The following problems provide practice in ascertaining the value of a given quantity of lumber, expressed in board feet and sold at the price of a thousand board feet. You are to ascertain the desired information by using the aliquot parts of 1,000.

1	2
a. 1,500 ft. at \$45.00 a 1,000	a. 625 ft. at \$55.50 a 1,000
b. 3,000 " " 48.00 " "	b. 875 " " 52.25 " "
c. 4,500 " " 52.00 " "	c. 1,125 " " 44.00 " "
d. 4,250 " " 38.75 " "	d. 625 " " 72.50 " "
e. 7,500 " " 42.50 " "	e. 1,625 " " 54.50 " "
f. 2,500 " " 65.00 " "	f. 2,125 " " 21.50 " "
g. 12,500 " " 45.50 " "	g. 4,250 " " 42.50 " "
h. 750 " " 41.50 " "	h. 1,750 " " 75.00 " "
i. 12,655 " " 100.00 " "	i. 1,250 " " 55.25 " "
j. 125 " " 38.50 " "	j. 6,288 " " 50.00 " "

NOTE: The aliquot parts of a thousand, used to the best advantage, are: 125 ft. = $\frac{1}{8}$; 250 ft. = $\frac{1}{4}$; 500 ft. = $\frac{1}{2}$.

EXERCISE No. 101, APPLICATION OF ALIQUOT PARTS

When the price is that of a ton of 2,000 pounds, and the quantity is given in pounds, the number of pounds may be divided by 2,000 to ascertain the number of tons, and the number of tons may then be multiplied by the price. If the number of pounds given is not an even number of tons, consider the remainder as the numerator of a fraction with 2,000 as the denominator.

Multiply the price by this fraction to ascertain the value of the fractional part of a ton. If the entire quantity is more than a ton, this may be expressed as an improper fraction with the total number of pounds as the numerator and 2,000 as the denominator. Multiply the price by the improper fraction reduced to its lowest terms. The result will be the total cost.

The following problems provide practice in ascertaining the value of commodities when the quantity is expressed in pounds and the price is that of a ton of 2,000 pounds. Show all the calculations necessary, using the aliquot parts of 2,000.

1	2
a. 1,500 lbs. of hay at \$22.50	a. 8,750 lbs. of coal at \$ 5.25
b. 2,500 " " coal " 7.25	b. 9,750 " " iron " 13.95
c. 800 " " hay " 24.50	c. 8,020 " " hay " 22.00
d. 12,250 " " steel " 19.50	d. 4,200 " " coal " 6.00
e. 2,500 " " coal " 5.50	e. 8,964 " " iron " 12.50
f. 5,000 " " iron " 14.50	f. 75 " " coal " 6.00
g. 1,750 " " hay " 24.00	g. 8,562 " " hay " 25.00
h. 7,500 " " steel " 22.50	h. 150 " " hay " 20.00
i. 87 " " hay " 20.00	i. 8,764 " " steel " 25.00
j. 2,250 " " hay " 25.50	j. 17,500 " " iron " 13.50

NOTE: The aliquot parts of a ton, used to best advantage, are: 125 lbs. = $\frac{1}{16}$; 200 lbs. = $\frac{1}{10}$; 250 lbs. = $\frac{1}{8}$; 500 lbs. = $\frac{1}{4}$.

EXERCISE No. 102, ALIUOT PARTS—ORAL DRILL

Aliquot parts or multiples of aliquot parts can be used to advantage whether they are involved in the quantity or the price. Thus, the value of 60 pounds of wheat at 85c a bushel of 60 pounds may be ascertained by the same process as that used to find the value of 85 pounds of wheat at 60c a bushel of 60 pounds. You should learn to utilize aliquot parts and multiples of aliquot parts in all possible calculations, because their use will enable you to solve a problem more quickly.

The following problems provide practice in using aliquot parts and multiples of aliquot parts, as discussed in the preceding exercises.

1. 90 lbs. of wheat at \$1.10 a bu.
2. 90 bu. of oats at 33 $\frac{1}{3}$ c a bushel.

3. 250 ft. of lumber at \$44 a M.
4. 168 ft. of lumber at \$25 a M.
5. 88 lbs. of corn at 63c a bu.
6. 120 yds. of ribbon at $8\frac{1}{3}$ c a yd.
7. 30 yds. of tape at $3\frac{1}{2}$ c a yd.
8. 12 qts. of plums at 25c a quart.
9. 96 lbs. of hay at \$25 a ton.
10. 125 lbs. of hay at \$24 a ton.
11. 128 lbs. of coal at \$5 a ton.
12. 24 lbs. of butter at $37\frac{1}{2}$ c a lb.
13. 80 bu. of barley at 75c a bu.
14. 820 lbs. of tobacco at $12\frac{1}{2}$ c a lb.
15. 40 bu. of corn at $87\frac{1}{2}$ c a bu.
16. What will be the cost of 86 lbs. of green apples at \$2.50 a bu. of 50 lbs.?
17. What will 96 lbs. of barley cost at 80c a bu. of 48 lbs.?
18. How much will 63 lbs. of buckwheat cost at 90c a bu. of 42 lbs.?
19. What will 96 lbs. of cotton seed cost at 60c a bu. of 32 lbs.?
20. What will be the cost of 165 lbs. of flaxseed at \$1.20 a bu. of 55 lbs.?
21. How much will 88 lbs. of hempseed cost at \$1.10 a bu. of 44 lbs.?
22. How many yards of silk at 75c can be bought for \$8.50?
23. How many yards of cheese cloth at $16\frac{2}{3}$ c can be bought for \$7.20?
24. How many yards of linen at $\$1.16\frac{2}{3}$ can be bought for \$22.40?
25. How many yards of silk at $\$1.66\frac{2}{3}$ can be bought for \$20?
26. How many pounds of sugar at $8\frac{1}{3}$ c can be purchased for \$2.75?
27. How many bushels of wheat at $\$1.12\frac{1}{2}$ can be purchased for \$9?
28. What will 250 lbs. of millet cost at \$2.50 a bu. of 50 lbs.?
29. How much will 44 lbs. of onion seed cost at \$2.80 a bu. of 28 lbs.?
30. What will be the cost of 42 lbs. of orchard grass seed at \$3 a bu. of 14 lbs.?

CHAPTER 33 BUSINESS PRACTICE

EXERCISE No. 103, AUDITING INVENTORY

1. On December 31 the Peoples Grocery Company had in stock the merchandise listed below. You are to audit this inventory and show: (a) the calculations necessary to verify each extension; (b) errors in the extensions; (c) the corrected total.

MERCHANDISE INVENTORY, DECEMBER 31, 19—

8	cases of Tag Soap.....	\$4.75	38	
7½	doz. LaCreme Mustard.....	1.75	13	13
225	lbs. Corn Meal.....	.03½	7	85
30	sacks Gold Medal Flour....	1.45	43	50
103	jars Preserves.....	.12½	12	88
87½	doz. No. 2 Canned Peas....	2.28¼	200	36
275	pkgs. Brillo.....	.08½	25	44
8	kegs Herring.....	1.23½	19	92
35¾	doz. cans of Peaches.....	2.75	99	31
45½	lbs. Mixed Candy.....	.25	10	24
286½	lbs. Chocolate Creams.....	.16⅔	43	98
78	pkgs. Mello Wheat.....	.15	11	70
325	lbs. Bokar Coffee.....	.50	178	75
146	lbs. Santos Coffee.....	.33⅓	47	95
248	lbs. 8 o'clock Coffee.....	.37½	98	62
986	lbs. Potatoes.....	.049	49	31
216	lbs. Rome Beauty Apples...	.055	12	85
427	lbs. Leaf Lard, unrendered .	.12½	61	91
46	lbs. Pork Sausage.....	.33⅓	15	18
36	doz. Tangerines.....	.30	12	75
58	doz. Oranges.....	.40	24	20
24	doz. Grapefruit.....	.98⅓	23	61
18	lbs. Grapes.....	.15	3	70
26½	doz. Strictly Fresh Eggs....	.485	12	85
24	lbs. Figs.....	.25	6	52
10	lbs. Dates.....	.33⅓	3	00
50	bxes. Superior Salt.....	.04	2	00
36	lbs. Nut Filled Dates.....	.25	8	10
Total.....				1087 61

2. The Dow Drug Company had the following merchandise in stock on December 31. You are to show (a) all the calculations necessary to verify the extensions and (b) the total value of the merchandise in stock.

488 tubes of Ipana tooth paste @ $37\frac{1}{2}c$	\$183.00	
360 tubes of Pebeco tooth paste @ $30c$	10.80	108.50
356 tubes of Forhan's tooth paste @ $25c$	89.00	
246 tubes of Squibb's tooth paste @ $33\frac{1}{3}c$	8.20	✓ 6/100
366 tubes of Kolynos tooth paste @ $16\frac{2}{3}c$	68.00	✓ 69/100
288 bottles of toilet water @ $41\frac{2}{3}c$	120.00	69/100
112 boxes of Woodbury's soap @ $43\frac{3}{4}c$	490.00	
128 boxes of Packer's tar soap @ $43\frac{3}{4}c$	56.00	292.47
128 boxes of Castile soap @ $18\frac{3}{4}c$	24.00	
363 bottles of Honey and Almond Cream @ $33\frac{1}{3}c$	123.00	
328 boxes of talcum @ $12\frac{1}{2}c$	41.00	
128 bottles of Palmolive shampoo @ $25c$	46.00	32.00
320 bars of Armour's bath soap @ $6\frac{1}{4}c$	40.00	26.00

EXERCISE No. 104, BILLING

Aliquot parts are used to advantage in billing and in extending the value of merchandise on inventories. The following problems provide practice in making extensions on bills. Show all the calculations necessary to arrive at (a) the extension of each item and (b) the total amount of the bill.

1. The Johnson Paper Company sold the Krehbiel Printing Company the following merchandise:

112,500 envelopes at \$1.20 a thousand	
14,765# of Regal Bond paper at $12\frac{1}{2}c$ a pound	
2,500# of ledger paper at $41\frac{2}{3}c$ a pound	
6,580# of news paper at $6\frac{1}{4}c$ a pound	
5,407# of Crown book paper at $8\frac{1}{3}c$ a pound	
2,586# of Champion Coated paper at $16\frac{2}{3}c$ a pound	
3,175# of Old Hampshire paper at $41\frac{2}{3}c$ a pound	
1,250 Columbian clasp envelopes at \$2.12 $\frac{1}{2}$ a thousand	
5,500 XXX white envelopes at \$1.68 $\frac{3}{4}$ a thousand	

2. On February 1 the Mills Grocery Company, dealer in wholesale groceries, sold H. M. Jameson, a retail grocer, the following merchandise:

- 3 sacks (300 lbs.) granulated sugar at $8\frac{1}{3}c$ a pound
- 25 doz. bars Red Cross soap at $55c$ a dozen
- 32 doz. cans peaches at $\$1.12\frac{1}{2}$ a dozen
- 75 doz. cans apples at $\$1.06\frac{1}{4}$ a dozen
- 135 lbs. rice at $8\frac{1}{3}c$ a pound
- $118\frac{3}{4}$ lbs. coffee at $56c$ a pound

3. On May 6 the Shillito Dry Goods Company sold Jenkins Bros., retail dry goods merchants, the following goods:

- 18 yds. of flannel at $\$2.91\frac{2}{3}$ a yard
- $66\frac{2}{3}$ yds. of black satin at $\$3.90$ a yard
- 24 yds. of ribbon at $6\frac{1}{4}c$ a yard
- 12 yds. of muslin at $16\frac{2}{3}c$ a yard
- 16 yds. of gingham at $18\frac{3}{4}c$ a yard
- 9 prs. of beige hose at $\$1.33\frac{1}{3}$ a pair
- 12 cards of buttons at $12\frac{1}{2}c$ a card

UNIT 7

PERCENTAGE

CHAPTER 34

PERCENTAGE REQUIRED

Per cent means by the hundred. It is used to describe fractional values expressing hundredths or a power of hundredths. The term 6% is equivalent to *six hundredths*; $\frac{1}{2}\%$, to *five thousandths*; $\frac{3}{4}\%$, to *seventy-five ten-thousandths*; 27%, to *twenty-seven hundredths*. The percentages mentioned, when expressed in the form of common and decimal fractions, are:

$$6\% = \frac{6}{100} = .06; \frac{1}{2}\% = \frac{\frac{1}{2}}{100} = .005; \frac{3}{4}\% = \frac{\frac{3}{4}}{100} = .0075; 27\% = \frac{27}{100} = .27.$$

The process of solving problems in percentage is the same as that applied in the solution of problems in common and decimal fractions; the denominator of the fraction representing the percentage in percentage problems is always 100. The usual process is to indicate the number representing the amount of the percentage as a decimal fraction.

24% of 25 is equivalent to $25 \times .24$ or a product of 6; 8% of 62 is equivalent to $62 \times .08$ or a product of 4.96; 15% of \$12.50 is equivalent to $12.50 \times .15$, or a product of 1.875 or \$1.88. When the value of the final product in the calculations of business problems is dollars and cents, and the fractional value of the cents is one-half or more, it is customary to regard this fraction as a full cent, and when the fraction is less than one-half, to discard it.

PERCENTAGE TERMS AND THEIR MEANING

The term *per cent* is used in business for indicating comparisons. The *base* is the number with which the comparison is being made. The *rate* is the fractional comparison. The *percentage* is the product of the base multiplied by the rate expressed as a decimal fraction.

Wilbur York, a salesman, is to receive as his compensation 8% of the sales he makes. During one month his sales are \$1,200. To ascertain the amount of his compensation (the percentage), it is necessary to multiply his sales (the base) by the rate per cent expressed as a decimal fraction: $\$1,200 \times .08 = \96.00 .

During the month of February Mr. York's sales are \$1,500; hence, his compensation is \$120: $\$1,500 \times .08 = \120.00 . If it is desired to compare his February sales with the January sales and to express the increase, \$300, as a rate per cent, the January sales will be the base, \$300 will be the percentage, and the rate will be determined. Since the base multiplied by the rate equals the percentage, it is evident that the percentage divided by the base will equal the rate: $\$300 \div \$1,200 = .25$, or 25%, the rate of increase. Mr. York sold \$300 more merchandise in February than in January, and by so doing increased his sales 25%, because the \$300 increase was $\frac{1}{4}$ of the January sales.

Mr. York wishes to increase his income in March to \$160. To do this, it is necessary for him to increase his sales because his income remains at 8% of his sales. Knowing his rate per cent and the income desired, he will naturally be interested in ascertaining the amount of goods he must sell in March in order to secure \$160. His reasoning will doubtlessly be as follows: "If \$160, the income I desire, is 8% of some number, then 1% of that number is $\frac{1}{8}$ of \$160, or \$20; if \$20 is 1% of the number, then 100% of the number must be 100 times \$20, or \$2,000. This means that I must sell \$2,000 worth of merchandise in March."

EXERCISE No. 105, PERCENTAGE REQUIRED

When the base and the rate are given, the percentage is the product of the base multiplied by the rate expressed as a decimal fraction. The following problems provide practice in ascertaining the percentage when the rate (first column) and the base (second column) are given.

1	2
a. 50% of 150	a. 8% of \$250
b. 30% " 60	b. 15% " 300
c. 90% " 90	c. 18% " 300
d. 80% " 27	d. 19% " 400
e. 60% " 60	e. 16% " 100
f. 40% " 40	f. 50% " 500

EXERCISE No. 106, PERCENTAGE REQUIRED

The following problems provide practice in ascertaining the percentage when the base and the rate are given. Arrange your work in the same form as that used in the multiplication of deci-

mal fractions. When the base is expressed as dollars and cents, the product (percentage) will be dollars and cents; hence, a fraction of a cent is treated as a whole cent if it is one-half cent or more, and is discarded if it is less than one-half cent.

1		2	
a. 15%	of 3,745	a. 78%	of \$4,756.35
b. 37%	" 5,846	b. 36%	" 625.31
c. 23%	" 9,283	c. 58%	" 473.57
d. 21%	" 1,473	d. 92%	" 3,127.68
e. 34%	" 8,463	e. 36%	" 45.32
f. 16%	" 8,136	f. 48%	" 314.68
g. 22%	" 8,415	g. 21%	" 3,147.82
h. 14%	" 9,236	h. 18%	" 37.23

NOTE: The base is the *multiplicand*; the rate, expressed as a decimal fraction, is the *multiplier*; and the percentage is the *product*. If the base is an abstract number, the percentage is an abstract number; if the base is a concrete number, the percentage is of the same denomination as the base: 10% of 100 is 10; 10% of \$100 is \$10.

EXERCISE No. 107, PERCENTAGE REQUIRED

When the rate is an aliquot part of 100, the percentage may be ascertained (a) by multiplying the base by the rate expressed as a decimal fraction, or (b) by multiplying the base by the rate expressed as a common fraction reduced to its lowest terms.

If the rate is $12\frac{1}{2}\%$ and the base is 72, the percentage is (a) $72 \times 12\frac{1}{2}\% = 9.00 = 9$, or (b) $72 \times \frac{12\frac{1}{2}}{100} = 72 \times \frac{1}{8} = \frac{72}{8} = 9$.

From this illustration you will note that multiplying the base by the rate expressed as a common fraction in its lowest terms is equivalent to dividing the base by the denominator of the common fraction when the numerator is 1.

The following problems provide practice in determining the percentage when the rate is an aliquot part of a dollar.

1		2	
a. 25%	of \$ 150.00	a. 4%	of \$ 625.50
b. $12\frac{1}{2}\%$	" 125.84	b. 50%	" 8,376.48
c. $16\frac{2}{3}\%$	" 209.64	c. $8\frac{1}{3}\%$	" 4,785.28
d. $8\frac{1}{3}\%$	" 1,067.40	d. $6\frac{1}{4}\%$	" 253.60
e. 10%	" 4,856.00	e. 25%	" 7,486.48
f. 5%	" 3,064.80	f. $33\frac{1}{3}\%$	" 3,743.25
g. 20%	" 584.75	g. $16\frac{2}{3}\%$	" 8,753.28
h. $33\frac{1}{3}\%$	" 437.64	h. $12\frac{1}{2}\%$	" 436.24

EXERCISE No. 108, PROBLEMS—PERCENTAGE REQUIRED

✓ 1. C. H. Dobson, a farmer, paid \$1,500 for a truck to be used on his farm. The rate of depreciation set up by the tax commission was 30% the first year, 25% additional the second year, and 15% additional each year thereafter. These figures mean that the taxable value of the truck at the end of the first year was cost less 30%, or \$1,050; at the end of the second year, cost less 55%; at the end of the third year, cost less 70%; etc. At the end of the third year the truck was destroyed by fire. Mr. Dodson carried fire insurance of \$700. What amount based on the taxable value should he collect from the insurance company?

2. In a certain school 4% of the total number of students were absent on January 26. There were 576 students present on that day. (a) What was the total enrollment? (b) How many students were absent?

3. G. B. Dougherty paid the R. & V. Motor Car Company \$2,532 for an automobile. This selling price included: (1) freight and tax, \$287; (2) dealer's commission of 20% on the selling price of the car at the factory. (a) How much did the R. & V. Motor Car Company pay the factory for this automobile? (b) How much commission did the R. & V. Motor Car Company receive? (c) What per cent of the factory price were the freight and the tax?

4. On November 2 C. E. Wright bought two \$1,000 Inland Steel Company $5\frac{1}{2}\%$ bonds at $95\frac{1}{2}$. He sold them on November 2 of the following year for $98\frac{3}{8}$. (a) How much was paid for the bonds? (b) How much was received for them when Wright sold them? (c) What was the per cent of profit on the investment?

5. A teacher offered a prize during the month of April to three classes, to be awarded to the one which had the best percentage of attendance. The enrollment was as follows: Class A, 35; Class B, 31; Class C, 28. During the month of the contest Class A had 8 absentees; Class B had 7 absentees; Class C had 6 absentees. There were 20 school days in the month. (a) Which class won the prize? (b) What was the per cent of attendance in each class?

6. A merchant lost 12% of his capital through the failure of one debtor, $7\frac{1}{2}\%$ of the remainder through the failure of another debtor, and had \$60,500.55 left. What was his original capital?

✓ 7. The Hillside Creamery, buying milk during the month of April, received the following supply: from R. A. Smith, 546 lbs.;

from H. L. Brooks, 1,595 lbs.; from R. W. Downing, 2,380 lbs.; from C. C. Davis, 4,540 lbs.; from J. M. Jones, 3,150 lbs. The creamery paid for the milk at the rate of $32\frac{1}{2}c$ a pound of butter fat. Through milk tests the milk was graded as follows: R. A. Smith, 3.96% butter fat; H. L. Brooks, 3.87%; R. W. Downing, 3.65%; C. C. Davis, 3.88%; J. M. Jones, 3.72%. (a) How much did each farmer receive? (b) How much did the creamery pay for all the milk?

8. The Lyons Company paid \$3,000 for a delivery truck on January 22. At the end of the first year it was depreciated 25%; at the end of the second year, 20%; and at the end of the third year, 15%. At the beginning of the fourth year it was exchanged for a new truck and an exchange allowance of \$1,000 was received.

(a) What was the amount of the depreciation? (b) What was the difference between the exchange value and the value on the books of the Lyons Company? (c) What per cent of the cost was the difference between the value recorded by the company and the exchange value?

9. If the base is \$2,521.25 and the rate is $7\frac{1}{2}\%$, what is the percentage?

10. The population of a certain city was 42,500 at one census period and 45,000 at the next period. (a) What was the increase in population? (b) the per cent of increase?

11. L. D. Mason paid \$10,000 for a farm. How much rent should he receive each year for the farm if the only expenses are the taxes of \$175.60 and if he desires that his money earn $7\frac{1}{2}\%$?

12. How much did A. L. Peterson, a salesman, receive as his compensation, if he was allowed $9\frac{1}{2}\%$ on his sales and the total volume of sales during a given period was \$13,781.65?

13. The yearly expenses for operating the office and the shipping room of Brown and Company were \$39,600. This amount was expended as follows: $33\frac{1}{3}\%$ for office salaries; $12\frac{1}{2}\%$ for clerks; $\frac{1}{2}\%$ for insurance; 10% for rent; $2\frac{1}{2}\%$ for depreciation and bad debts; $8\frac{1}{2}\%$ for freight and drayage; $12\frac{1}{2}\%$ for traveling expenses; and the remainder for general expenses. Find the amount of each item of expense.

14. R. B. Jacks invested, at the end of last year, 20% of his year's income in stock that yields $6\frac{1}{4}\%$ on his investment. If his salary is \$800 a month, what is the return on his stock investment?

CHAPTER 35

RATE REQUIRED

When the *base* and the *percentage* are given, the *rate* is ascertained by dividing the percentage by the base. The principle involved is the same as that in the proof of multiplication by division. The base is the *multiplicand*; the rate, the *multiplier*; and the percentage, the *product*.

EXERCISE No. 109, RATE REQUIRED

Since the percentage is the result of the base multiplied by the rate, it is evident that the percentage divided by the base will give the rate.

$$\begin{array}{r}
 .181 + \\
 287.64 \overline{) 52.15000} \\
 \underline{28 \ 764} \\
 23 \ 3860 \\
 \underline{23 \ 0112} \\
 37480 \\
 \underline{28764} \\
 8716
 \end{array}$$

The illustration at the left shows the method of ascertaining the rate when the base is \$287.64 and the percentage, \$52.15. The percentage is the dividend, and the base is the divisor. Since the quotient is in thousandths, the rate is .181 +, or 18.1 + %.

It is necessary to keep in mind the fact that the rate is the numerator of a fraction, the denominator of which is hundredths; hence, the quotient in the process of division, in which the base is the divisor and the percentage is the dividend, will be a decimal fraction.

When the base is not contained in the percentage an exact number of hundredths of times, the division should be continued, in decimal fractions, to at least three decimal places.

The following problems provide practice in ascertaining the rate when the percentage and the base are given:

- | 1 | 2 |
|---|--|
| a. 25 is what per cent of 100? | a. 28# is what per cent of 32#? |
| b. 14 is what per cent of 56? | b. $17\frac{1}{2}$ is what per cent of 35? |
| c. 17 is what per cent of 51? | c. 18 is what per cent of 54? |
| d. \$10 is what per cent of \$100? | d. 15# is what per cent of 60#? |
| e. \$125 is what per cent of \$1,000? | e. 25c is what per cent of \$1.00? |
| f. 21# is what per cent of 56#? | f. 44# is what per cent of 220#? |
| g. 10 is what per cent of 100? | g. 25 is what per cent of 625? |
| h. 9 is what per cent of 81? | h. 18 is what per cent of 90? |
| i. 13 is what per cent of 91? | i. 125 is what per cent of 625? |
| j. $66\frac{2}{3}$ is what per cent of 200? | j. 61 is what per cent of 183? |

3

- a. 445 is what per cent of 1,262?
- b. 318 is what per cent of 900?
- c. 756 is what per cent of 252?
- d. 1,644 is what per cent of 32,508?
- e. \$375.55 is what per cent of \$2,408.40?
- f. \$252.50 is what per cent of \$2,500?
- g. 1,018 is what per cent of 16,485?
- h. 327 is what per cent of 585?
- i. 25,562 ft. is what per cent of 100,570 ft.?
- j. 750 is what per cent of 150?
- k. 3,265 is what per cent of 12,440?
- l. \$90.90 is what per cent of \$9,090?

EXERCISE No. 110, PERCENTAGE PROBLEMS—RATE REQUIRED

The following problems provide practice in applying the principles of percentage. Show all the calculations necessary to arrive at the facts desired.

1. The following items are quoted from a bargain sale advertisement. The first amount is the former sale price, and the second is the present sale price. You are to ascertain: (a) the reduction in price; and (b) the per cent of this reduction, based on the former price.

- | | |
|----------------------------|-------------------------|
| a. \$15 coats at \$12.50 | i. \$30 dresses at \$18 |
| b. \$4 dresses at \$3 | j. \$50 rugs at \$40 |
| c. \$5 dresses at \$4.50 | k. \$120 rugs at \$90 |
| d. \$3 galoshes at \$2.50 | l. \$6 shoes at \$3.50 |
| e. \$35 coats at \$20 | m. \$8 shoes at \$5 |
| f. \$20 coats at \$12 | n. \$10.50 shoes at \$7 |
| g. \$15 coats at \$10 | o. \$7 shoes at \$4.95 |
| h. \$25 dresses at \$14.50 | p. \$5 shoes at \$3.50 |

2. On January 2 James Bigelow purchased a used Buick automobile for \$1,250. On January 4 he sold this car for \$1,400. Ascertain: (a) the profit and (b) the per cent of profit.

3. On January 2 C. H. Reed paid \$2,150 for a new automobile. On December 31 of the same year he purchased another automobile and received \$950 credit on the purchase price of the used car. (a) How much was the depreciation, that is, the difference between the cost of the used car and its exchange value? (b) What was the rate per cent of monthly depreciation?

4. A. L. Downing paid \$5,500 for a farm and sold it for \$6,250. How much was his per cent of profit after he paid \$55.80 for taxes?

5. The Brown Manufacturing Company paid \$2,700 for a machine on January 2. The bookkeeper was instructed to record depreciation on the machine at the rate of $12\frac{1}{2}\%$ each year. After four years the company exchanged the machine for a new one and received an exchange allowance of \$972. (a) What was the book value (cost less recorded depreciation) of the machine when it was exchanged? (b) What should have been the annual rate of depreciation to have made the book value equal the exchange value at the end of the fourth year?

6. Walter Brown paid \$1,500 for a lot and \$6,275.80 for the construction of a house. In addition to the cost of the house and lot, he paid \$250 for paving assessments and \$82.50 for taxes. He sold the lot, and the house upon completion, for \$9,000. What was (a) the net profit, and (b) the per cent of profit?

7. On May 1 Adolph Howe paid \$8,500 for a house and lot. While he owned the property he paid expenses as follows: for repairs and painting, \$285.65; for taxes, \$191.87; for insurance, \$24. He rented the property on May 1 and collected the monthly rent of \$75 for May, June, July, August, and September. On September 30 he sold the property for \$11,250. Mr. Howe wishes to know: (a) the total profit made and (b) the per cent of profit based on the purchase price of the property.

8. On January 3 the K. B. Selman Co. bought office equipment amounting to \$450. The rate of depreciation was fixed at 10% a year. At the end of the third year the equipment was changed for new furniture and an allowance of \$325 was made on the old furniture. (a) What was the book value of the equipment when it was exchanged? (b) What should have been the annual rate of depreciation to have made the book value equal the exchange value at the end of the third year?

9. Robert Morgan paid \$10,560 for a house and lot and sold them for \$12,350. How much was his per cent of profit after he paid \$158.40 for taxes?

10. On June 5, J. B. Hall paid \$775 for a used Studebaker automobile. On June 10 he sold this car for \$825. He desires to know: (a) the profit and (b) the per cent of profit based on the cost. On June 15 he paid taxes which were assessed against the car while it was in his possession. (c) What effect did these taxes have on the profit and the per cent of profit?

11. I. L. Pierson, a farmer, collected in cash from the sales of farm products in a given year, \$3,562.48. He paid as expenses in operating the farm during the same year, \$722.65. You are to ascertain: (a) his net profit and (b) the per cent of his expenses based on his sales.

12. The Model Laundry purchased a delivery truck for \$1,800 and kept it for four years. In accordance with the tax schedule, during the first year the truck was depreciated 35%; the second year, 20%; the third year, 15%; and the fourth year, 10%. At the end of the fourth year it was exchanged for another truck at an exchange allowance of \$750. You are to show the calculations necessary to determine: (a) the book value of the truck at the time it was exchanged; (b) the difference between the exchange value and the book value; and (c) the rate per cent this difference is above or below the book value.

13. (a) The records of the Van Horn Manufacturing Company for one year show total sales, \$862,981.50, and total selling expenses, \$90,613.06. What per cent of the sales were the selling expenses?

(b) J. H. Hurdig, a salesman of the Van Horn Manufacturing Company, sold merchandise for \$29,684.72. His selling expenses were \$4,155.86. How much more or less than the average for the company was his per cent of selling expenses based on sales?

14. Your father paid \$1,200 for a lot on which to build a home. Before building operations were begun, he sold the lot at a profit of $66\frac{2}{3}\%$ and bought another lot at 20% less than the selling price of the first one. (a) What did he receive for the first lot? (b) What did he pay for the second lot? (c) What was the profit? (d) What was the per cent of profit based on the cost of the first lot?

15. The number of high school graduates increased from 21,880 at the end of the nineteenth century to 224,367 thirty years later. What was the per cent of increase?

16. In a recent year there were 81,034 high school teachers as compared to 9,120 thirty years before. What was the per cent of increase?

17. The population of a certain city was 407,621 in one census year and 502,682 in the next census year. (a) What was the increase in population in this city? (b) the per cent of increase?

EXERCISE No. 111, COST OF MERCHANDISE SOLD

The merchant does not always know the exact cost of each article sold, but he does know, at the end of the year, the cost of all merchandise sold during the year. This information is ascertained from (a) the cost of merchandise on hand at the beginning of the year, (b) the cost of merchandise bought during the year, and (c) the merchandise on hand at the end of the year. The cost of merchandise bought includes (a) the invoice cost of the merchandise bought, less the value of any merchandise returned, plus (b) the transportation cost.

Percentage may be used to advantage in comparing the various items which enter into the cost of merchandise purchased. The merchant is interested in having a comparison of these facts in order to control better the cost of future purchases.

If the value of the merchandise on hand at the beginning of the year is \$2,000 and the cost of merchandise during the year is \$3,000, it is quite evident that there should be in stock at the end of the year merchandise valued at \$5,000 if none has been sold. If the inventory shows that the value of merchandise on hand is only \$1,500, it is quite evident that the merchandise sold during the year cost \$3,500. This is the difference between the amount that should have been on hand, if none had been sold, and the amount that is on hand.

The following problems provide practice in applying percentage to the costs of merchandise purchased.

1. A. L. Young had \$12,416.84 worth of merchandise on hand at the beginning of the year and \$11,642.50 worth on hand at the end of the year. You are to ascertain: (a) the difference between the two inventories, and (b) the per cent of decrease in the value of the inventory at the end of the year when compared with the value of the beginning inventory.

2. J. C. Smith purchased merchandise amounting to \$19,871.62 during a certain year and paid freight on the purchases amounting to \$1,141.36. The freight was what per cent of the purchase price?

3. During the same year the returned purchases of J. C. Smith (Problem 2), that is, the merchandise returned to creditors, was \$1,004.65. What per cent of the merchandise bought was returned?

4. The following facts are recorded in the ledger of George Busse, a retail merchant: total purchases, \$61,748.55; transportation cost, \$2,748.65. During the previous year the total purchases were \$75,527.86 and the transportation cost, \$3,165.54. Mr. Busse wishes to know: (a) the comparison in per cent of the purchases for the two years, (b) the comparison in per cent of the transportation cost for the two years, (c) the per cent of transportation cost on purchases for this year, and (d) the per cent of transportation cost on purchases for the previous year.

5. The bookkeeping records show the following facts affecting the goods sold this year: beginning inventory, \$14,651.72; purchases during the year, \$28,765.92; returned purchases, \$562.90; freight, \$864.95; ending inventory, \$9,756.82. The same facts for the preceding year were: beginning inventory, \$15,562.40; purchases, \$25,987.62; returned purchases, \$659.80; freight, \$1,242.41; ending inventory, \$14,651.72. You are required to show the calculations necessary to ascertain: (a) the cost of the goods sold this year; (b) the cost of the goods sold last year; (c) the per cent of increase or decrease; (d) the comparison in per cent of the beginning inventory of this year with that of last year; and (e) the comparison in per cent of the ending inventory of this year with that of last year.

6. The following facts are recorded in the ledger of John J. Reo, a retail merchant: total purchases, \$54,689.72; transportation cost, \$2,150.60. During the previous year the total purchases were \$60,357.38 and the transportation cost, \$2,759.63. You are required to show the calculations necessary to ascertain: (a) the comparison in per cent of the purchases for the two years, (b) the comparison in per cent of the transportation cost for the two years, (c) the per cent of transportation cost on purchases for this year, and (d) the per cent of transportation cost on purchases for the previous year.

EXERCISE No. 112, SALES

The profit on the sales of merchandise is ascertained by subtracting from the net sales the net cost of the merchandise sold. The net sales are the total sales less any returns made by customers. The method of ascertaining the cost of merchandise sold is explained in Exercise No. 111. It is customary to use the net sales as a base when ascertaining the rate per cent of income on sales or of operating expense. It is only when a comparison of items which enter into the cost is desired that the cost is used.

The following problems provide practice in applying percentage to business problems involving the purchase and sale of merchandise and expenses incurred in connection therewith.

1. Cost of merchandise sold was \$14,786.95; selling price, \$17,562.40. You are required to show the calculations required to find the per cent of profit.

2. Total sales during the year were \$32,561.40; returns of merchandise by customers, \$846.65. What per cent of the merchandise sold was returned?

3. Total sales during the year were \$85,962.40; total selling expenses including total expense of salesmen, \$9,762.40. What per cent of the sales were the selling expenses?

4. Total sales, \$587,642.95; merchandise returned by customers for credit, \$1,262.40; allowances granted customers because goods were not up to standard, \$462.75; total selling cost, \$32,562.54; total administrative cost, \$31,562. You are required to show the calculations necessary to ascertain: (a) the per cent of merchandise returned by customers, (b) the per cent of allowances to customers, (c) the rate per cent of selling expense, and (d) the rate per cent of administrative expense.

5. Cost of merchandise sold was \$458,962.95; sales were \$654,527.55. What was the per cent of profit based on sales?

6. Total sales during the year were \$16,280.70; returns of merchandise by customers, \$423.32. What per cent of the merchandise sold was returned?

7. Cost of merchandise sold was \$61,257.89; sales were \$87,961.30. What was the per cent of profit based on sales?

CHAPTER 36

BASE REQUIRED

When the rate and the percentage are given, the base is ascertained by dividing the percentage by the rate expressed as a decimal fraction. The principle involved is the same as that in the proof of multiplication by division. The base is the multiplicand; the rate, the multiplier; and the percentage, the product.

The following problems provide practice in ascertaining the base when the rate (first column) and the percentage (second column) are given:

1	2	3
a. 12%...144	a. 7%...81.00	a. $12\frac{1}{2}\%$...24.00
b. 10%...280	b. 11%... 2.20	b. 20%.... 5.00
c. 15%...450	c. 15%... 4.50	c. $16\frac{2}{3}\%$ 6.00
d. 3%...225	d. 15%...45.00	d. 75%.... 2.25
e. 6%...120	e. 14%... 2.80	e. 40%.... 1.60
f. 7%...490	f. 7%.... .72	f. 25%.... 5.00
g. 15%...600	g. 7%.... 8.10	g. 25%....25.00
h. 20%...320	h. 9%.... 1.80	h. 10%.... .10

EXERCISE No. 113, BASE REQUIRED

When the rate and the percentage are given, and it is necessary to write the solution, it is advisable to express the rate in the form of a decimal fraction before dividing. Thus, if the rate is $18\frac{1}{4}\%$ and the percentage is \$66.66, the solution requires that \$66.66 be divided by .1825, as illustrated below.

$$\begin{array}{r}
 \$365.26 \\
 .1825 \overline{) \$66.660000} \\
 \underline{54 \ 75} \\
 11 \ 910 \\
 \underline{10 \ 950} \\
 9600 \\
 \underline{9125} \\
 4750 \\
 \underline{3650} \\
 11000 \\
 \underline{10950} \\
 50
 \end{array}$$

In the problem at the left, there are four decimal places in the divisor and only two in the dividend; hence, it is necessary to annex two ciphers to the dividend. The result of dividing the dividend by the divisor with these ciphers annexed will be dollars. Since there is a remainder after finding the dollars, it is necessary to annex additional ciphers in order to ascertain the cents. Since the remainder is less than one-half, it is discarded.

The following problems provide practice in ascertaining the base when the rate and the percentage are given:

1	2	3
a. 27%...\$ 22.52	a. 7.4%...361	a. $12\frac{1}{2}\%$...\$287.62
b. 7%...181.65	b. 29%...127	b. 33%... 55.42
c. 9%... 54.55	c. $3\frac{1}{4}\%$...525	c. 16%... 34.14
d. 28%... 43.15	d. $21\frac{1}{2}\%$... 87.5	d. 75%...241.04
e. 13%... 38.65	e. 3.68%... 72.60	e. 66%...205.87
f. 15%... 44.44	f. 15.7%...261.3	f. 8%... 51.65
g. 44%... 98.89	g. 8.8%...541.52	g. 20%...201.11
h. 31%... 36.42	h. $16\frac{3}{4}\%$... 72.5	h. $37\frac{1}{2}\%$... 55.56

EXERCISE No. 114, PROBLEMS

1. Beginning inventory, \$37,462.91; purchases during the year, \$52,827.36; ending inventory, \$30,562.44. (a) What per cent of the goods purchased was sold? (b) If the selling price was 25% in excess of the cost, what were the total sales for the year? P.R.C.

2. A certain city shows an increase in birth rate of 2,475 in one year. This is a $1\frac{7}{8}\%$ increase. Find the birth rate for the previous year.

✓ 3. If the rate is $9\frac{1}{2}\%$ and the percentage is \$126.55, what is the base?

✓ 4. A. L. Hodge, a traveling salesman, received \$9,876.55 as compensation for his service in a certain year. What were his total sales if he received $7\frac{1}{2}\%$ as his commission?

5. J. J. Alderson inherited the property at 729 May Street. The building contains six apartments which rent as follows: Apartments A, B, and C, \$85 a month for each; Apartments D and E, \$75 a month for each; and Apartment F, \$65 a month. The average expenses of maintaining the property during the past 5 years have been \$52.50 a month. What should be the market value of this property if Mr. Alderson wishes his money to earn 8%?

✓ 6. A dealer sold 315 hogs, or $37\frac{1}{2}\%$ of the number he had bought during the week. (a) How many did he have left? (b) What per cent was unsold? 62%

7. A merchant realized a profit of $12\frac{1}{2}\%$ above all cost in operating his business. If the cost of operation was \$2,750, and the cost of goods sold, \$10,000, (a) what were the total sales? (b) what was the net gain?

8. On January 3 the Prompt Service Electric Company paid \$1,450 for an automobile truck for delivery purposes. The rate of depreciation recorded on the books, as fixed by the tax laws, was 30% the first year, 20% additional the second year, 15% additional the third year, and 10% additional for each year thereafter. The company kept this truck for 4 years and then traded it in for a new one, receiving an exchange allowance of \$652.24. (a) What was the book value of the truck? (b) What is the difference, in per cent, between the exchange value and the book value compared to the cost value?

9. C. H. Penrod, salesman for the Acme Manufacturing Company, received \$9,426.87 as his salary and commission for a certain year. His salary was paid to him in monthly installments of \$500, and his commission was paid at the end of the year. He received a commission of $7\frac{1}{2}\%$ on his sales. (a) What was the amount of his sales? (b) What was the amount of commission collected at the end of the year?

10. A merchant received a check from one of his customers for \$1,860.24, marked "In full of account." According to the terms of the sale, the customer was to have $2\frac{1}{2}\%$ discount if he paid the bill within ten days. The check was received within this period. What was the amount of the sale for which this check was in payment? *Sale is Base.*

CHAPTER 37

APPLICATION OF TERMS

The following problems provide written practice in the solution of percentage problems. Copy them on tablet paper in the same form as the problems are stated, inserting the correct figures where question marks are given; mark the figures you have supplied by drawing a line under them. Submit with the problems all your calculations. If an answer is not an integer, show the decimal in hundredths.

When the base and the percentage are given in one amount, and the percentage is a separate amount, subtract to ascertain the base; when the base, less the percentage, is given in one amount, and the percentage is a separate amount, the base is the sum of the two. With any two of the three essential elements given, the third can be ascertained by multiplication or division.

	Base	Rate	Percentage	B. + P.	B. - P.
1.	\$1,678.40	25%	?	?	?
2.	?	?	\$37.08	\$301.93	?
3.	\$1,264.75	?	\$189.71	?	?
4.	?	?	\$77.27	?	\$566.62
5.	\$7,843.20	18%	?	?	?
6.	\$1,657.45	8%	?	?	?
7.	\$9,864.37	?	\$3,452.53	?	?
8.	?	?	\$192.34	\$1,671.89	?
9.	?	?	\$122.06	?	\$1,621.59
10.	?	?	1,865.51	?	6,614.10
11.	\$6,543.90	16 $\frac{2}{3}$ %	?	?	?
12.	\$7,864.85	?	?	\$8,651.34	?
13.	\$3,487.70	?	?	?	\$3,175.41
14.	\$4,874.44	?	\$536.19	?	?
15.	?	?	\$563.22	\$9,950.22	?
16.	?	?	361.85	9,408.05	?
17.	\$5,580.10	2 $\frac{1}{2}$ %	?	?	?
18.	\$4,589.40	?	\$917.88	?	?
19.	246.00	?	?	258.30	?

EXERCISE No. 115, SALES PROBLEMS

Whether a salesman receives a salary for his services, a combination of salary and commission, or a commission only, the value of his services to the business concern which employs him is always measured by his sales. If he receives a salary, and his sales do not compare favorably with those of the other salesmen working under the same conditions, he will eventually be replaced by a more efficient salesman.

The following problems provide practice in the application of percentage to the problems of selling.

1. The Brown Grocery Company employed four salesmen. During the month of January their sales were as follows:

Brown.....	\$2,750.45	Smith.....	\$2,309.16
Clark.....	2,396.48	Snyder.....	2,845.87

Each salesman was allowed a commission of $8\frac{1}{2}\%$ on his sales. You are to ascertain: (a) the total sales of the four salesmen; (b) the average sales for the month; (c) the rate per cent the sales of each salesman were above or below the average; (d) the commission due each salesman for the month.

2. During February the sales of the four salesmen mentioned in Problem 1 were as follows:

Brown.....	\$2,954.55	Smith.....	\$2,145.72
Clark.....	2,463.68	Snyder.....	2,800.85

Show: (a) the average sales for February; (b) the per cent of increase or decrease of the average sales as compared with the January average; (c) the increase or decrease of each salesman's sales over those of the preceding month; (d) the per cent of this increase or decrease; (e) the commission due each salesman on the February sales.

3. The L. J. Mann Hardware Company has four salesmen, each of whom receives a salary for his services. During the month of July the sales of each salesman were as follows:

Bates.....	\$829.63	Day.....	\$1,017.30
Davis.....	641.92	Jones.....	913.55

You are to ascertain: (a) the total sales made by the four salesmen; (b) the average sales for the month; (c) what per cent each salesman's sales were above or below the average.

4. Warren Brothers, retail drygoods merchants, have four salesmen, each of whom receives a definite salary plus a commission of 2% on the sales he makes above the average sales. During the month of August the sales of these four salesmen were as follows:

Hays.....	\$1,142.96	Knight.....	\$1,429.94
Joyce.....	1,233.96	Ross.....	1,646.42

You are to show all the calculations necessary to ascertain: (a) the average sales, and (b) the commission due each salesman whose sales are above the average.

5. The twelve salesmen listed below comprise the sales force of The Hunt Manufacturing Company. At the close of the current business year the sales of each salesman were as follows:

Bates...\$13,167.44	Davis...\$15,095.33	King...\$11,412.96
Bauer... 13,498.72	Daly... 15,809.88	Rowe... 12,331.97
Craig... 13,782.22	Hale... 14,166.18	Saylor... 13,209.76
Culp... 10,773.50	Joyce... 13,224.65	Smith... 12,709.43

Each salesman is to receive for his services a salary of \$200 a month, and a commission of $3\frac{1}{2}\%$ if his sales are the average or more than the average and only $2\frac{1}{2}\%$ if his sales are less than the average. You are to ascertain: (a) the total sales for the year; (b) the average sales; (c) the commission due each salesman for his sales during the year; (d) the total income of each salesman for the year; and (e) the rate per cent of the cost of each salesman's sales on a \$100-unit basis.

NOTE: A \$100-unit basis means that the salesmen's sales are expressed in even hundred dollars. Thus, the sales made by Mr. Bates will be expressed as \$13,200; Mr. Daly, \$15,800; Mr. Hale, \$14,200; Mr. Saylor, \$13,200; etc.

EXERCISE No. 116, RATE PER CENT OF PROFIT OR LOSS

When property is purchased and sold by an individual who is not engaged in a business enterprise, it is customary to use the cost price as the base to ascertain the percentage of profit or loss.

The following problems provide practice in ascertaining the percentage of profit or loss when the cost is used as the base.

When the percentage (profit or loss) is an aliquot part of the base (cost price), the rate will be the same aliquot part of 100%. Thus, in the first problem the profit, \$100, is one-third of the base; hence the rate is $33\frac{1}{3}\%$, because this is one-third of 100%.

1		2	
Cost	Selling Price	Cost	Selling Price
a. \$300.00	\$400.00	a. \$ 2.50	\$ 3.50
b. 200.00	300.00	b. 125.00	150.00
c. 250.00	300.00	c. 16.00	20.00
d. 800.00	900.00	d. 17.50	20.00
e. 500.00	750.00	e. 37.50	50.00
f. 25.00	30.00	f. 15.00	12.50
g. 2.50	5.00	g. 17.50	15.00
h. 12.50	15.00	h. 125.00	100.00

EXERCISE No. 117, PROFIT AND LOSS

For the following problems show all the calculations necessary to ascertain: (a) the profit or loss and (b) the per cent of profit or loss expressed as an integer or as a mixed number with the fraction expressed decimally in hundredths.

1		2	
Cost Price	Selling Price	Cost Price	Selling Price
a. \$ 1,650.45	\$ 1,995.50	a. \$335.00	\$330.00
b. 550.00	725.00	b. 825.50	820.25
c. 225.45	200.50	c. 99.95	97.65
d. 775.25	815.65	d. 104.14	115.66
e. 12,500.00	14,650.00	e. 4.75	6.25
f. 200.50	192.25	f. 44.50	41.20

EXERCISE No. 118, PROFIT AND LOSS

It is customary for the merchant or the manufacturer to use the selling price as the base in all calculations. Thus, if a merchant sells an article for \$1.25 and the cost price is \$1, the percentage of profit is calculated on \$1.25, the selling price, instead of \$1, the cost price. The same mathematical process is applied, whether the selling price or the cost price is used as a base; but the rate per cent will be different because the cost price is different from the selling price. Thus, the percentage of profit on the sale referred to above, would be 20% if the selling price were the base, and 25% if the cost price were the base.

The following problems provide practice in ascertaining the percentage of profit or loss when the selling price is used as a base:

1		2	
Cost Price	Selling Price	Cost Price	Selling Price
a. \$1,250.00	\$1,500.00	a. \$25,000.00	\$30,000.00
b. 1,000.00	1,200.00	b. 21,000.00	28,000.00
c. 1,500.00	1,800.00	c. 1,500.00	1,200.00
d. 1,400.00	1,600.00	d. 37,500.00	50,000.00
e. 7,500.00	9,000.00	e. 32,000.00	40,000.00
f. 8,400.00	9,600.00	f. 1,250.00	1,000.00
g. 13.50	15.00	g. 7,500.00	8,000.00
h. 5,280.00	6,000.00	h. 9,900.00	9,000.00
i. 7,200.00	8,000.00	i. 8,500.00	8,000.00

EXERCISE No. 119, RATE PER CENT OF PROFIT OR LOSS

The following problems provide practice in ascertaining the percentage of profit or loss when the cost and the selling price are given and the selling price is to be used as the base:

1		2	
Cost Price	Selling Price	Cost Price	Selling Price
a. \$22,451.75	\$24,526.60	a. \$17,716.65	\$17,005.04
b. 1,237.55	1,152.40	b. 7,622.55	8,004.05
c. 12,862.65	16,911.40	c. 2,262.65	2,141.50
d. 7,827.65	8,001.01	d. 8,887.18	9,919.90
e. 32,786.65	38,242.55	e. 4,465.86	4,392.99
f. 9,900.50	10,400.25	f. 1,255.15	1,400.75

NOTE: Express the rate per cent as an integer, or as a mixed number with the fraction expressed decimally in thousandths.

EXERCISE No. 120, DEPRECIATION

When a business man purchases an automobile, a motor truck, a typewriter, or other property for use in his business, he must take into consideration the decrease in the value of this property because of its use; otherwise his records will not show the correct amount of profit or loss resulting from the operation of the business. This decrease in value is taken care of through recording as depreciation a certain per cent of the cost value of the property, usually at the end of each business year. The percentage decided upon as the amount of depreciation is based on the cost price.

If a motor truck costs \$2,500 and should be depreciated 20% each year, \$500, or one-fifth of the cost value, is recorded each year as the depreciation.

The present, or book, value of the truck is ascertained by subtracting the depreciation from the cost value of the truck.

The following problems provide practice in ascertaining the present value of property which has been depreciated through use. Copy the problems as given, inserting the correct amounts where the question marks appear.

			Depr.	Depr.	Depr.	Depr.	
			1st	2d	3d	4th	Present
	Cost	Rate	Year	Year	Year	Year	Value
1.	\$2,200	20%	?	?	?	?	?
2.	2,500	15%	?	?	?	?	?
3.	100	18%	?	?	?	?	?
4.	375	12½%	?	?	?	?	?
5.	5,000	17%	?	?	?	?	?
6.	3,500	20%	?	?	?	?	?
7.	750	15%	?	?	?	?	?
8.	1,000	16%	?	?	?	?	?
9.	125	20%	?	?	?	?	?
10.	140	14%	?	?	?	?	?
11.	2,850	17%	?	?	?	?	?
12.	1,675	15%	?	?	?	?	?

CHAPTER 38

TRADE DISCOUNT

Trade discount is a deduction from the catalog or list price, usually stated in the form of one or more discounts. Its purpose is to provide for the fluctuation in the cost of raw material, labor, etc., in order that standard list prices may be provided.

The Standard Manufacturing Company, a manufacturer of plumbers' supplies, issues a catalog in which are listed the various articles offered for sale to plumbers. The list price of a certain type of bath tub, as shown in this catalog, is \$160. Before a customer has a tub installed, he usually wishes to make a selection, and the plumber permits him to do this from the catalog. The price given in the catalog, \$160, is the price at which the plumber is supposed to sell the tub. However, the price to the plumber is given in a special confidential price list which shows the catalog price and the trade discount or discounts allowed.

If the discounts allowed by the Standard Manufacturing Company are 20% and 10%, the net cost of the bath tub to the plumber is \$160 less 20%, and \$128 less 10%, or \$115.20. Each discount is deducted separately. The result is the same in this problem, whether the 10% is deducted first and the 20% second, or vice versa.

EXERCISE No. 121, TRADE DISCOUNT

The following problems provide practice in deducting trade discounts:

- | 1 | 2 |
|---------------------------|---------------------------------|
| a. \$100 less 10% and 10% | va. \$100 less 20%, 10%, and 5% |
| b. 60 less 25% and 10% | b. 80 less 12½%, 10%, and 10% |
| c. 35 less 40% and 10% | vc. 150 less 20%, 20%, and 20% |
| d. 100 less 20% and 10% | d. 200 less 20%, 10%, and 10% |
| e. 150 less 20% and 10% | e. 100 less 15% and 5% |
| f. 200 less 25% and 10% | f. 125 less 20%, 20%, and 10% |
| g. 400 less 40% and 20% | g. 150 less 33⅓%, 20%, and 10% |
| h. 75 less 20% and 20% | h. 200 less 50%, 40%, and 10% |
| i. 80 less 10% and 10% | i. 60 less 50%, 40%, and 50% |
| j. 90 less 20% and 20% | j. 30 less 10%, 10%, and 10% |
| k. 75 less 33⅓% and 10% | k. 40 less 50%, 20%, and 10% |

EXERCISE No. 122, TRADE DISCOUNT

When a written solution is necessary to ascertain the net price in a problem involving trade discounts, one of the four methods illustrated in this and the succeeding exercises may be used. The final result is the same, regardless of the order in which the discounts are deducted.

The illustration below shows the method of ascertaining the net price when each discount is deducted separately. The solution shows the method of ascertaining the net price of six machines listed at \$140 each, with trade discounts of 25% and 15%.

\$840	\$630
.25	.15
4200	3150
1680	630
\$210.00	\$94.50
\$840	\$630.00
210	94.50
\$630	\$535.50

The first discount is obtained by multiplying the total list price by the discount expressed as a decimal fraction. The net price after the first discount has been deducted is \$630. The second discount is obtained by multiplying \$630 by the discount expressed as a decimal fraction. The net price after the second discount has been deducted is \$535.50, the net price of all the machines. When more than one item is involved, calculate the discounts on the total list price of all the items.

The following problems provide practice in finding the net price when the list price and the trade discounts are given. Prove the correctness of your solutions by deducting the discounts in the reverse order.

1. List price, \$140, less 25% and 15%. What is the net price?
2. What is the net cost of 25 stoves listed at \$22.40 each, with discounts of 18% and 10%?
3. List price, \$44.50; discounts, 15% and 12½%. What is the net price?
4. What is the net cost of a radio which is listed in a catalog at \$92.50, less discounts of 25%, 5%, and 5%?
5. List price, \$196; discounts, 20%, 12½%, and 5%. What is the net price?
6. What is the net price of 8 wash stands listed at \$32.50 each, with discounts of 25%, 20%, 10%, 7½%, and 5%?
7. List price, \$210.50; discounts, 25%, 16⅔%, and 10%. What is the net price?
8. What is the net price of two dozen scatter rugs listed at \$3.75 each, with discounts of 15%, 10%, and 5%?
9. List price, \$35.40; discounts, 10%, 10%, and 5%. What is the net price?

EXERCISE No. 123, TRADE DISCOUNT

When the rate of discount is an aliquot part of a dollar, the discount may be ascertained by dividing the list price by the denominator of the fraction representing the aliquot part. Subtracting the discount obtained by this operation from the list price will give the net price.

The illustration below shows the method of applying aliquot parts to ascertain the net price of a radio outfit listed at \$290, with discounts of 25%, 16 $\frac{2}{3}$ %, and 12 $\frac{1}{2}$ %.

4)\$290.00	\$217.50
72.50	36.25
\$290.00	8)\$181.25
72.50	\$22.66
6)\$217.50	\$181.25
36.25	22.66
	\$158.59

The first net price is ascertained by dividing the list price by 4 (25% is $\frac{1}{4}$ of 100), and subtracting the quotient from the list price. The second net price is ascertained by dividing the first net price by 6 (16 $\frac{2}{3}$ % is $\frac{1}{6}$ of 100), and subtracting the quotient from the first net price. The third net price is ascertained by dividing the second net price by 8 (12 $\frac{1}{2}$ % is $\frac{1}{8}$

of 100), and subtracting the quotient from the second net price. The result is the desired net price, because there are only three discounts allowed.

The following problems provide practice in ascertaining the net price when the list price is given and the trade discounts are aliquot parts of a dollar:

✓ 1. The list price of a stove was \$162.50, with trade discounts of 16 $\frac{2}{3}$ % and 5%. What was the net price?

2. What was the net cost of three radio outfits listed at \$350 each, with trade discounts of 12 $\frac{1}{2}$ %, 5%, and 2%?

✓ 3. The list price of a bookcase was \$185, less 20%, 12 $\frac{1}{2}$ %, and 5%. What was the net price?

4. What was the net cost of five suites of furniture listed at \$476 each, with trade discounts of 20%, 16 $\frac{2}{3}$ %, 5%, and 2%?

✓ 5. What would be the net cost of two pianos listed at \$1,680 each, with trade discounts of 25%, 20%, 12 $\frac{1}{2}$ %, and 5%?

6. The list price of an automobile was \$1,540, with trade discounts of 20%, 16 $\frac{2}{3}$ %, 12 $\frac{1}{2}$ %, and 5%. What was the net price?

7. The list price of a chair was \$42.50, with trade discounts of 16 $\frac{2}{3}$ % and 5%. What was the net price?

8. What was the net cost of three desks listed at \$25.50 each, with trade discounts of 12 $\frac{1}{2}$ %, 5%, and 2%?

9. What would be the net cost of two bedroom suites listed at \$275 each, with trade discounts of 25%, 20%, 10%, and 5%?

EXERCISE No. 124, TRADE DISCOUNT

The net price, that is, the list price less the trade discount, may be found by multiplying the list price by the difference between 1 and the first rate of discount, by multiplying this product by the difference between 1 and the second rate, and so on until all the rates have been used. The final result is the same as if each discount had been calculated and then subtracted from the amount to which it applied. Solutions obtained by the two methods may, of course, vary a few cents if a fraction of a cent is discarded or is considered to be a whole cent.

The illustration below shows the process explained above applied to finding the net price of a refrigerator listed at \$240 with trade discounts at 35% and 15%.

\$240	\$156
.65	.85
1200	780
1440	1248
\$156.00	\$132.60

The first net price is ascertained by multiplying the list price by .65, which is 100% minus 35%. The second net price is the product of \$156 multiplied by .85, which is the difference between 100% and 15%. This product is the desired net price, because only two discounts are allowed.

The following problems provide practice in finding the net price when the list price and the trade discounts are given. Prove your solutions by using the method illustrated in Exercise No. 122.

1. List price, \$4.50; discounts, 15%, 10%, 10%, 5%, 5%, and 5%. What is the net price?

2. What is the net price of 32 dozen hatchets listed at \$9.75 a dozen, with discounts of 20%, 12½%, 10%, 5%, and 5%?

3. List price, \$182.50; discounts, 25%, 15%, 12½%, 10%, 5%, and 5%. What is the net price?

✓ 4. What is the net cost of 9 refrigerators listed at \$65.50 each, with discounts of 20%, 15%, 12½%, and 10%?

✓ 5. List price, \$48.50; discounts, 25%, 15%, and 12½%. What is the net price?

6. What is the net cost of 6 automobile tires listed at \$47.50 each, with discounts of 40%, 33⅓%, 5%, and 5%?

7. List price, \$51.65; discounts, 33⅓%, 25%, 10%, and 5%. What is the net price?

✓ 8. List price, \$178.90; discounts, 25% and 16⅔%. What is the net price?

EXERCISE No. 125, TRADE DISCOUNT

The net price, the list price less the trade discount, may be found by subtracting each discount from 1, by multiplying these amounts, and then by multiplying their product by the list price.

The illustration below shows the method of finding the net price of a desk listed at \$165, with discounts of 15% and 15%.

1.00	\$165
.15	.7225
.85	825
.85	330
425	330
680	1155
.7225	\$119.2125

Each rate is deducted separately from 100%. The differences are multiplied. The product is the equivalent per cent value of the net price. Multiplying the list price by this result gives the desired net price. Deducting the per cent value of the net price from 100% will give the net value of the series of discounts. $100\% - 72.25\% = 27.75\%$; this is the one discount equivalent to the discount series.

The following problems provide practice in applying the method illustrated above. Prove your results by using one of the methods given in the preceding exercises.

1. What would be the cost of six kitchen cabinets listed at \$78.50 each, with discounts of 15% and 5%?

2. What single discount is equivalent to 20%, 15%, and $12\frac{1}{2}\%$?

3. What is the net price of eight overstuffed chairs listed at \$125 each, with discounts of $16\frac{2}{3}\%$, 10%, and 5%?

4. A dealer paid \$861.84 for an automobile. He was allowed discounts of 20%, 10%, and 5% from the list price. What was the list price?

5. What would be the cost of three vacuum cleaners listed at \$57.80 each, with discounts of 15% and 2%?

6. The list price of a rug was \$360, with discounts of $16\frac{2}{3}\%$, $12\frac{1}{2}\%$, and 5%. What was the net price?

7. What one discount will express the value of: (a) 65%, 35%, and 10%; (b) 90%, 10%, and 5%; (c) 75%, 75%, and 10%; (d) 25%, 25%, 10%, and 5%; (e) 45%, 40%, 30%, and 25%; (f) 50%, $33\frac{1}{3}\%$, 25%, 20%, $16\frac{2}{3}\%$, $12\frac{1}{2}\%$, and 10%?

8. What would be the cost of a typewriter listed at \$120, with discounts of 20% and 5%?

CHAPTER 39

CASH DISCOUNT

Cash discount refers to a discount allowed for the prompt payment of an invoice or bill. It is assumed that a customer will make an effort to pay his bill within a specified time, if by so doing he can secure a deduction from the amount of the bill. Cash discount has no connection with trade discount. If there are trade discounts applicable to the list price of an article, the net price, which is the list price less the discounts, is used in the extension on the invoice.

The cash discount is usually indicated on the invoice as a part of the terms of purchase. Thus, "2/10, n/30" indicates that the purchaser may deduct 2% from the amount of the invoice if he pays within 10 days from the date of the invoice; but if he does not pay within that time, the full amount will be due 30 days from the date of the invoice.

The following problems provide practice in ascertaining the amount of the cash discount:

1	2	3
a. \$180.00, 2%	a. \$212.50, 2%	a. \$ 97.50, 1%
b. 250.00, 1%	b. 300.00, 4%	b. 98.15, 1%
c. 35.00, 2%	c. 125.00, 5%	c. 27.65, 2%
d. 120.00, 3%	d. 160.00, $2\frac{1}{2}\%$	d. 36.00, $2\frac{1}{2}\%$
e. 225.00, 1%	e. 180.00, $1\frac{1}{2}\%$	e. 88.50, 1%
f. 38.50, 1%	f. 22.50, 2%	f. 19.29, 1%
g. 209.65, 1%	g. 35.65, 1%	g. 212.50, 2%
h. 9.85, 1%	h. 204.00, 2%	h. 99.00, 2%
i. 35.25, 2%	i. 308.00, $1\frac{1}{2}\%$	i. 75.50, 1%
j. 150.00, 3%	j. 115.00, 3%	j. 99.80, 1%

EXERCISE No. 126, CASH DISCOUNT

When an invoice subject to discount is to be paid in full, the amount required to pay it is ascertained by multiplying the amount of the invoice by the rate per cent stated in the terms and by deducting the discount from the amount of the invoice. When

only a part of an invoice subject to discount is paid within the discount period, the purchaser is entitled to a discount on the amount paid. If the terms are 2%, 10 days, and he pays part of his account within that time, each 98c he pays entitles him to a credit of \$1.00. The amount of the payment is divided by .98 to ascertain the amount with which his account will be credited. The difference between the amount he pays and the amount with which he is credited is the cash discount.

The following problems provide practice in the application of cash discount:

Date	Amount	Terms	Date of Payment	Amount Paid	Cash Discount
1. Jan. 2	\$216.40	2/10, n/60	Jan. 9	In full	
2. May 4	909.16	1/30, n/60	June 3	In full	
3. Feb. 9	475.85	3/10, n/30	Feb. 19	\$300	
4. Oct. 6	98.60	2/30, n/60	Nov. 5	In full	
5. Nov. 2	752.60	3/10, n/30	Nov. 10	\$500	
6. Jan. 11	55.65	2/10, n/30	Jan. 20	In full	
7. Apr. 4	317.65	1½/10, n/30	Apr. 13	\$200	
8. May 9	455.08	1/30, n/90	June 7	In full	
9. June 4	396.55	2/30, n/60	July 2	\$300	
10. Dec. 1	508.16	1/10, n/30	Dec. 10	In full	
11. Feb. 11	87.55	3/30, n/60	Mar. 8	In full	
12. Sept. 6	115.55	2/30, n/60	Oct. 1	In full	
13. Feb. 9	210.50	1/30, n/60	Feb. 28	In full	
14. Mar. 14	715.85	2/10, n/30	Mar. 20	\$500	
15. Oct. 27	194.78	3/10, n/30	Oct. 31	In full	
16. July 3	256.48	2/10, n/60	July 12	\$150	

EXERCISE No. 127, TRADE AND CASH DISCOUNTS

The following invoices provide further practice in (a) auditing extensions, (b) auditing trade discounts, and (c) ascertaining the amounts necessary to pay the invoices in accordance with the terms. Show all the calculations necessary to verify the extensions and the trade discounts and to ascertain the net amount necessary to pay each invoice if the cash discount is taken.

EXERCISE No. 128, CASH DISCOUNT

The following problems provide practice in applying the principles of cash discount, and other principles discussed in previous chapters:

1. On May 16 The Holmes Furniture Company purchased from the Grand Rapids Furniture Company furniture amounting to \$1,847.65. According to the terms of this purchase, the Grand Rapids Furniture Company was to prepay the freight and charge The Holmes Furniture Company for only one-half of it. The invoice included the value of the merchandise and one-half of the freight, \$188.56. The terms of the sale were 3/30, n/60. On June 14 the cashier of The Holmes Furniture Company issued a check in payment of this invoice, in accordance with the terms. You are required to show all the calculations necessary to determine the amount of this check. You may assume that The Holmes Furniture Company understood that discount was not to be deducted from the amount of the freight.

✓ 2. On August 19 The Central Hardware Company purchased hardware invoiced at \$1,627.56, from the Simmons Hardware Company. The terms were 2/30, n/60. When the merchandise was delivered, the management of The Central Hardware Company discovered that an error had been made in ordering additional stock of one item when this was not needed. The company asked the Simmons Hardware Company for the privilege of returning this merchandise, the value of which was \$248.50. On September 10 a credit bill was issued for the value of this returned merchandise. On September 16 the cashier of The Central Hardware Company issued a check in payment of the amount due the Simmons Hardware Company. You are to show all the calculations necessary to determine the amount of this check.

3. On June 12 The Globe Clothing Company purchased clothing amounting to \$3,856.90 from The Crown Clothing Company. The terms of the invoice of The Crown Clothing Company were October 1, 3/10, 2/30, n/60. These terms indicated that 3% might be deducted if payment was made on or before October 11; 2% if payment was made on or before October 31; and no discount thereafter. The Globe Clothing Company could not pay the invoice in full but on October 9 it sent a check for \$2,000 to apply as a part payment. On October 30 it sent another check for \$1,000;

and on December 1, a check for the balance. Show all the calculations necessary to ascertain the amount of the last check.

4. On July 9 The Watson Supply Company purchased 6 desks from the Dietz Desk Company at \$148.50 each, with trade discounts of 15%, 10%, and 5%. The desks were billed at the net price, subject to 3% cash discount if payment was made within 10 days. On July 18 a check was issued in payment of these 6 desks. On August 1 the receiving clerk of The Watson Supply Company reported to the manager that one of the desks was in bad condition. The manager wrote to the Dietz Desk Company and asked for an adjustment. The Dietz Desk Company suggested that the desk be returned and that it send a check for the amount The Watson Supply Company had paid for it. This suggestion was made by the Dietz Desk Company because it did not have in stock another desk to replace the one damaged and it seemed only fair that The Watson Supply Company should have a check to close the account. You are to show: (a) the amount of the check issued by The Watson Supply Company on July 18, and (b) the amount of the check received from the Dietz Desk Company as a reimbursement for the desk which was returned.

5. On April 6 The Central Publishing Company purchased paper billed at \$2,122.65 from The Woods Paper Company. The terms were July 1, 3/10, 2/30, n/60, paper delivered at the freight station of The Central Publishing Company. On April 9 the paper was delivered with a freight bill of \$209.65. The notation on the invoice of The Woods Paper Company, "receipted freight bill will be accepted as part payment of this invoice," authorized The Central Publishing Company to pay the freight and to charge it to The Woods Paper Company. On July 9 The Central Publishing Company paid \$1,200 on this purchase. On July 25 The Central Publishing Company sent a check to The Woods Paper Company to balance its account. What should have been the amount of this check?

EXERCISE No. 129, CASH DISCOUNT

As explained on page 170, cash discount refers to the discount allowed for prompt payment. The discount which a merchant allows his customers is referred to as *discount on sales*, and the discount allowed the merchant by his creditors, as *discount on purchases*.

Since all of the merchant's creditors do not allow a discount on purchases, and since the same discount is not allowed by all, it is necessary to determine the rate per cent of purchases discount by treating the purchases as the base and purchases discount as the percentage. Since all customers do not take advantage of the discount offered for prompt payment, it is necessary to treat the total sales from customers who bought on account as the base and the sales discount as the percentage in order to determine the rate per cent of sales discount.

The following problems provide practice in determining the rate per cent of purchases discount and sales discount:

1. During the business year the total sales on account of the A. R. Neil Company were \$181,486.50, and the discounts allowed customers because of prompt payment, \$1,581.75. You are to ascertain the per cent of discounts allowed customers because of prompt payment.

2. During the same business year the purchases on account of the A. R. Neil Company (Problem 1) were \$102,473.25, and the purchases discounts received because of prompt payment, \$1,282.56. What was the per cent of purchases discounts?

3. During two consecutive years the facts regarding sales and sales discounts as recorded on the books of the Mabley Company were as follows: first year—sales on account, \$75,261.98; discounts allowed customers, \$1,050.75; second year—sales on account, \$91,719.66; discounts allowed customers, \$1,242.51. You are to ascertain: (a) the per cent of the sales discounts for the first year, and (b) the per cent of the sales discounts for the second year.

4. During a certain year the net sales on account of the Electric Shop were \$259,642.55, and the sales discounts, \$2,575.78. What per cent of the sales was sales discounts?

5. The purchases discounts recorded on the books of Adair & Brown for a year were \$2,961.55. What were the total purchases during the year if this amount represents an average discount of $1\frac{1}{2}\%$?

6. The total sales on account of The Gem Store during a certain year were \$86,421.75, and the discounts allowed customers for prompt payment during the same year, \$1,146.55. What was the rate per cent of sales discount?

CHAPTER 40

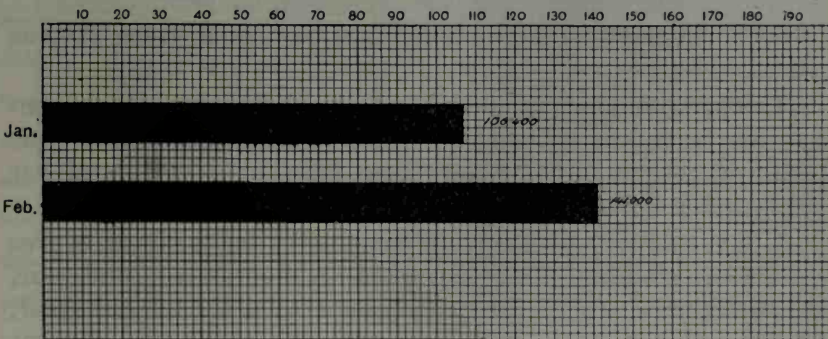
GRAPHS

A *graph* is a drawing, the purpose of which is to set before the eyes in true proportion the relation between certain statistical facts. Graphs afford a very convenient means of presenting to the business man facts concerning his business, and their relation to its operation and progress. The meaning and the purpose of graphs are best explained through the illustrations and the problems in this chapter.

EXERCISE No. 130, HORIZONTAL BAR GRAPHS

The *bar graph* is one that sets forth the comparison of certain mathematical facts by means of bars of different lengths. These bars are usually drawn on scale paper so as to permit a definite interpretation. The illustration below shows a horizontal bar graph setting forth a comparison of sales of a business concern, on a hundred-dollar unit basis, over a period of two months. These sales expressed in figures are:

January..... \$106,431.29 February.... \$141,010.39



In this graph each vertical line represents a unit value of \$2,000. Thus, each five units, as indicated by the heavy line, represents \$10,000. You can readily see that it is much easier to interpret the increase or the decrease in sales from these bars, than from the same facts stated in figures.

The following problems provide practice in preparing bar graphs. If possible, use paper ruled for the preparation of graphs:

but if this is not available, then draw lines on tablet paper making them conform, as nearly as possible, to the scale.

1. The sales of the Johnson Publishing Company for three consecutive years were as follows: first year, \$68,527.50; second year, \$72,209.11; third year, \$75,516.40. Set forth these facts in a horizontal bar graph, using \$1,000 as a unit.

2. The manager of the Fair Store asks you to show, in a horizontal bar graph, the following facts regarding the expenses of operating the business during the current year. The selling expenses were as follows: salaries of sales clerks, \$22,565; salary of sales manager, \$5,000; advertising, \$4,565.20. The general expenses were as follows: officers' salaries, \$18,500; rent, \$9,000; store supplies used, \$1,965.50; miscellaneous supplies, \$2,560.75. The comparison of these expenses should show the relation of (a) each selling expense to the total selling expenses, and (b) each general expense to the total general expenses.

3. The incomes of four salesmen employed by the Michael's Manufacturing Company were as follows for the current year:

Name	Salary
R. E. Douglas.....	\$7,500
H. C. Jameson.....	9,426
H. Y. Joiner.....	6,954
R. T. Lee.....	9,562

Set forth these facts in a horizontal bar graph, using \$100 as a unit.

4. The attendance of a certain high school during three consecutive years was as follows: first year, 1,655; second year, 1,875; third year, 2,155. Show these facts in a horizontal bar graph, using a twenty-five unit basis.

5. The tax rate in a certain community for a period of five years was as follows: first year, \$22.50 a thousand; second year, \$25.40 a thousand; third year, \$27.60 a thousand; fourth year, \$24.70 a thousand; and fifth year, \$22.90 a thousand. Present these facts in ten-cent units in a horizontal bar graph.

6. The receipts of the Acme Theater during a period of four weeks were as follows: first week, \$2,250.65; second week, \$4,142.55; third week, \$3,541.75; fourth week, \$2,627.25. Present these facts in a horizontal bar graph in \$25 units.

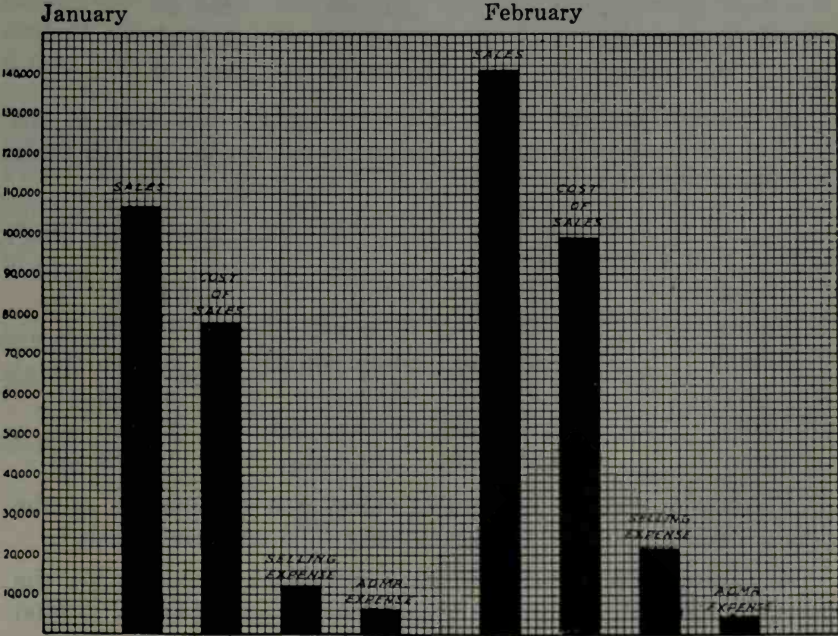
7. Albany, Utica, and Rochester are on the main line of the New York Central Railroad between New York and Buffalo. The distance between New York and Buffalo is 438 miles; between New York and Albany is 142 miles; between Albany and Utica is 96 miles; and between Utica and Rochester is 124 miles. Set forth these facts in a horizontal bar graph in ten-mile units.

EXERCISE No. 131, VERTICAL BAR GRAPHS

The vertical graph differs from the horizontal graph only in the method of making the drawing. The parallel lines in the vertical graph are drawn from bottom to top, while in the horizontal graph, they are drawn from left to right.

The illustration below shows a vertical bar graph setting forth a comparison of the sales, cost of sales, and expenses of the Davidson Mercantile Company for the months of January and February.

	Sales	Cost of Sales	Selling Expense	Administrative Expense
Jan....	\$106,410.50	\$77,476.40	\$12,010.30	\$6,350.75
Feb....	141,002.60	99,210.50	21,751.25	4,220.80



The following problems provide practice in drawing vertical bar graphs to portray facts presented by figures. Use regular graph paper, if available; but if not, make your drawings according to a scale on tablet paper.

1. The sales and cost of sales as recorded in the ledger of the Johnson Company for a period of four years were as follows:

	Sales	Cost of Sales
First year.....	\$40,161.50	\$19,271.90
Second year.....	44,992.54	21,217.75
Third year.....	32,516.46	26,218.75
Fourth year.....	48,219.73	25,516.73

Prepare a vertical bar graph showing the facts regarding the sales of the Johnson Company, using a \$1,000 unit basis.

2. The Marland Manufacturing Company employs four salesmen. During January the sales and the selling expenses of each of the salesmen were as follows:

	Sales	Selling Expenses
A. L. Dick.....	\$ 9,471.80	\$408.75
J. B. Morse.....	1,216.55	206.47
C. J. Arnold.....	7,216.48	315.48
T. B. Morris.....	11,560.27	389.59

Prepare a vertical bar graph showing a comparison of the sales of each salesman with his selling expenses, using \$100 units as a basis for the sales and the selling expenses.

3. The sales of the Textbook Publishing Company during a certain year were as follows:

January:....	\$20,483.78	July.....	\$14,491.74
February....	18,560.37	August.....	14,932.57
March.....	12,416.55	September....	48,415.83
April.....	7,918.54	October.....	32,316.37
May.....	4,751.38	November....	20,156.40
June.....	6,281.80	December....	16,473.83

Prepare a vertical bar graph showing a comparison of the sales for each month of the year, using \$500 units as a basis.

4. Construct a vertical bar graph showing a comparison of the per capita wealth of the ten cities given on page 181, using \$100 units as a basis:

Chicago.....	\$1,239	Los Angeles....	\$2,646
Cincinnati.....	2,376	New Orleans....	1,290
Cleveland.....	2,801	New York.....	1,964
Detroit.....	2,644	Pittsburgh.....	1,992
Kansas City.....	2,203	San Francisco..	3,401

5. The following statistics were given out by the street rail-ways of a city. The average number of passengers carried each day was 433,000, distributed over the hours of the day as follows:

From 5 to 6 a.m....	13,000	From 3 to 4 p.m....	23,000
From 6 to 7 a.m....	29,000	From 4 to 5 p.m....	25,000
From 7 to 8 a.m....	52,000	From 5 to 6 p.m....	68,000
From 8 to 9 a.m....	34,000	From 6 to 7 p.m....	29,000
From 9 to 10 a.m....	15,000	From 7 to 8 p.m....	19,000
From 10 to 11 a.m....	13,000	From 8 to 9 p.m....	12,000
From 11 to 12 a.m....	13,000	From 9 to 10 p.m....	10,000
From 12 to 1 p.m....	15,000	From 10 to 11 p.m....	12,000
From 1 to 2 p.m....	20,000	From 11 to 12 p.m....	8,000
From 2 to 3 p.m....	20,000	From 12 to 5 a.m....	3,000

(a) Construct a vertical bar graph to show the day's traffic in hourly comparisons, using 1,000 units as a basis. (b) What per cent of the total traffic was carried between the hours of 5 and 6 p.m.? (c) what per cent between 7 and 8 a.m.?

6. The annual shipment of oranges from California for eight consecutive years was as follows:

First Year..	10,200,000 boxes	Fifth Year...	15,300,000 boxes
Second Year.	10,800,000 boxes	Sixth Year...	13,800,000 boxes
Third Year..	13,200,000 boxes	Seventh Year	6,300,000 boxes
Fourth Year.	10,600,000 boxes	Eighth Year.	17,900,000 boxes

Construct a vertical bar graph showing a comparison of the shipments for the eight years, using the current year as the eighth year and the seven preceding years as the others.

7. During a period of one year the average price of sugar was as follows:

January.....	6.4c	July.....	8.1c
February.....	6.5c	August.....	7.9c
March.....	6.7c	September.....	7.9c
April.....	6.6c	October.....	8.1c
May.....	7.1c	November.....	8.3c
June.....	7.6c	December.....	8.7c

Construct a vertical bar graph showing a comparison of the price of sugar during each of the twelve months of the year, using one cent as a basis.

EXERCISE No. 132, CURVED GRAPHS

A *curved graph* may be used for the same purpose as a bar graph. When there are a number of figures which have a certain relation to one another and to the whole, the curved graph will show this relation even better than the bar graph.

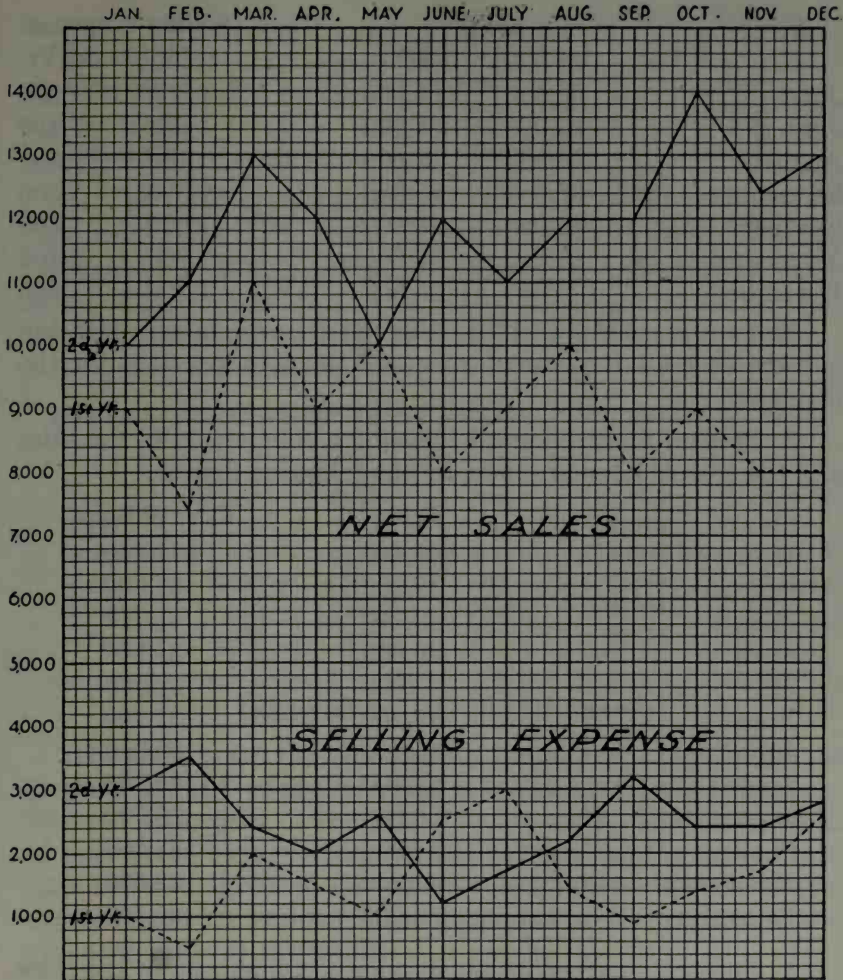
The illustration on the following page is a curved graph illustrating the sales and the selling expenses of a firm over a period of two years. The facts from which this graph was made are as follows:

	Sales		Selling Expenses	
	1st Yr.	2d Yr.	1st Yr.	2d Yr.
January.....	\$ 9,000	\$10,000	\$1,000	\$3,000
February.....	7,400	11,000	500	3,500
March.....	11,000	13,000	2,000	2,400
April.....	9,000	12,000	1,500	2,000
May.....	10,000	10,000	1,000	2,600
June.....	8,000	12,000	2,500	1,200
July.....	9,000	11,000	3,000	1,700
August.....	10,000	12,000	1,400	2,200
September.....	8,000	12,000	900	3,200
October.....	9,000	14,000	1,400	2,400
November.....	8,000	12,400	1,700	2,400
December.....	8,000	13,000	2,600	2,800

The following problems provide practice in preparing curved graphs:

1. The sales and the selling expenses of the Jewell Mercantile Company during a period of two consecutive years were as follows:

	Sales		Selling Expenses	
	1st Yr.	2d Yr.	1st Yr.	2d Yr.
January.....	\$20,000	\$22,000	\$1,500	\$1,300
February.....	22,500	24,000	1,200	1,300
March.....	23,000	24,500	1,300	1,200
April.....	25,000	26,500	1,350	1,250
May.....	27,000	28,000	1,500	1,350



The sales at the end of January of the first year were \$9,000; hence, the line begins at the point where the \$9,000 line and the end of January meet. The sales for the month of February of the first year decreased \$1,600; hence, the line goes down to the point where \$7,400 and March meet. There was an increase of \$3,600 in March; hence, the line goes up to a point where March and \$11,000 meet; etc. A dotted line is used for the first year and a solid line for the second year in order to distinguish between them. The selling expenses are shown at the bottom, because the amounts are smaller. The plan is the same: the dotted line is used for the first year, and the solid line for the second year. This graph presents interesting facts to the owner of the business, from which he can determine a comparison of the sales for the two years and the cost of selling for the same period.

	Sales		Selling Expenses	
	1st Yr.	2d Yr.	1st Yr.	2d Yr.
June.....	30,000	34,000	1,500	1,200
July.....	35,000	33,000	1,600	1,400
August.....	32,500	31,000	1,700	1,300
September.....	27,000	29,000	1,500	1,500
October.....	26,000	28,500	1,300	1,400
November.....	25,500	26,000	1,200	1,100
December.....	25,000	25,500	1,200	1,000

Prepare a curved graph setting forth these facts. Use the current year for the second year and the year previous for the first year.

2. Prepare a curved graph showing a comparison of the sales and the cost of sales as shown by the following figures:

	Sales	Cost of Sales
January.....	\$49,400	\$34,250
February.....	47,200	33,800
March.....	43,150	31,750
April.....	49,600	34,500
May.....	47,000	32,500
June.....	45,500	31,700
July.....	45,400	32,000
August.....	48,400	35,200
September.....	56,000	33,700
October.....	47,800	33,200
November.....	47,200	33,600
December.....	54,600	35,500

3. Prepare a curved graph showing a comparison of the sales and the cost of sales as shown by the following figures:

	Sales	Cost of Sales
January.....	\$52,500	\$34,250
February.....	49,700	33,800
March.....	45,250	31,750
April.....	52,600	34,500
May.....	50,200	32,500
June.....	48,300	31,700
July.....	47,500	32,000
August.....	51,600	35,200

	Sales	Cost of Sales
September.....	\$53,400	\$33,700
October.....	50,500	34,200
November.....	49,700	33,600
December.....	57,800	35,500

4. The table given below shows the sales of the millinery department of the H. S. Pogue Company for two years. From this information prepare a curved graph showing a comparison of the sales for the two years. Use a dotted line to show the sales for the first year and a solid line to show the second year's sales.

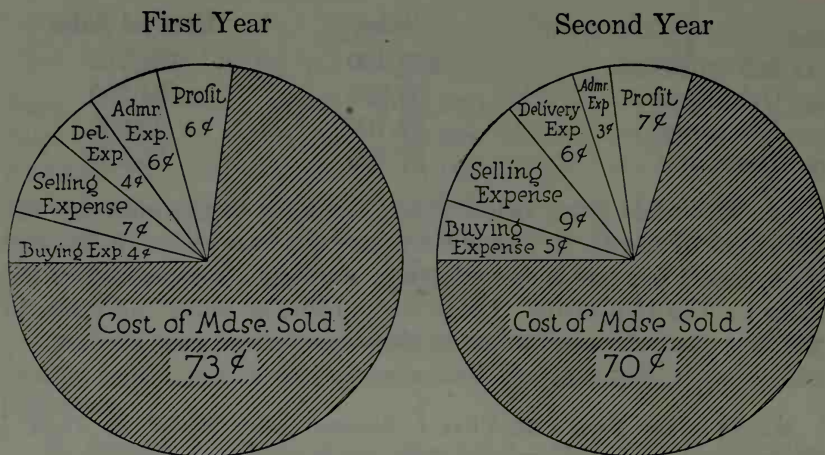
MONTH	1ST YEAR	2D YEAR	MONTH	1ST YEAR	2D YEAR
Jan.	\$1,000	\$1,200	July	\$1,830	\$1,960
Feb.	1,150	1,300	Aug.	1,910	1,890
Mar.	1,920	1,800	Sept.	2,050	2,150
Apr.	1,600	1,850	Oct.	2,160	2,270
May	1,510	1,600	Nov.	1,900	1,800
June	1,730	1,900	Dec.	1,530	1,620

EXERCISE No. 133, CIRCLE GRAPHS

The *circle graph* may be used for the same purpose as the bar graph or the curved graph, but it is better adapted to the presentation of facts on a percentage or dollar basis. Thus, each dollar of sales made by a merchant must include: (a) the cost of merchandise sold (invoice cost plus transportation cost and buying expense); (b) the various selling expenses; (c) the various general expenses; and (d) the profit.

The illustration on the following page shows circle graphs applicable to each dollar of sales for a period of two years. The facts from which these graphs were prepared are as follows:

	First Year	Second Year
Cost of Merchandise Sold.....	\$14,965.00	\$15,697.50
Buying Expense.....	820.00	1,121.25
Selling Expense.....	1,435.00	2,018.25
Delivery Expense.....	820.00	1,345.50
Administrative Expense.....	1,230.00	672.75
Profit.....	1,230.00	1,569.75



Costs and Profit in Each One Dollar Sale

You will observe that in these illustrations the hundred cents in each dollar are included. In the first year the cost of the merchandise sold was 73c; the buying expense, 4c; the selling expense, 7c; the delivery expense, 4c; the administrative expense, 6c; and the profit, 6c. During the second year the cost of the merchandise sold was reduced to 70c, but the buying expense increased 1c, the selling expense increased 2c, and the delivery expense increased 2c. The administrative expense was one-half of what it was the first year, and the profit was 1c more. These facts will help the merchant to decrease his costs and increase his profits for the next year.

The following problems provide practice in: (a) ascertaining the per cents of the various costs; and (b) presenting these values in cents in a circular graph:

1. The cost of sales, the expenses in connection with the operation of the business, and the profit, shown on the report received by Mr. Arnold of the Arnold Publishing Company, for a certain year were as follows:

Cost of Merchandise Sold.....	\$52,810.24
Buying Expense.....	3,300.64
Selling Expense.....	9,076.76
Delivery Expense.....	1,650.32
Advertising Expense.....	4,950.96
Administrative Expense.....	4,950.96
Profit.....	5,776.12

Prepare a circular graph setting forth these facts.

2. The cost of sales, the selling expense, the general expense, and the profit of the D. C. Dirck Company during a certain year were as follows:

Cost of Merchandise Sold.....	\$108,917.60
Selling Expense.....	40,417.81
General Expense.....	20,214.55
Profit.....	46,964.44

Prepare a circular graph setting forth these facts.

3. The L. A. Brewer Manufacturing Company had on hand at the beginning of the current business year raw material to the value of \$16,492.55. The value of the raw material purchased during the year was \$21,416.30. The cost of labor during the year was \$9,422.16, and of manufacturing expense, \$6,227.41. The inventory of raw material at the end of the year was \$14,219.65. The sales for the year were \$52,417.19. Prepare a circular graph with sales representing the entire circle, and the raw material cost, labor cost, manufacturing expense, and the gross profit representing parts of the circle.

4. Prepare a circular graph for the Dixie Confectionery Store, based on the following facts: cost of merchandise sold, 49c; buying expense, 11c; selling expense, 5c; delivery expense, 9c; administrative expense, 9c; profit, 17c.

5. Prepare a circular graph setting forth the following facts obtained from the report of the Kenner Drug Company: cost of merchandise sold, 64c; buying expense, 8c; selling expense, 6c; delivery expense, 4c; administrative expense, 6c; profit, 12c.

6. Prepare a circular graph for the J. P. Manners Co. based on the following facts: cost of merchandise sold, 66c; buying expense, 3c; selling expense, 16c; delivery expense, 5c; profit, 10c.

7. Prepare a circular graph setting forth the following facts obtained from the report of the Langman & Langman Co.: cost of merchandise sold, 59c; buying expense, 5c; selling expense, 15c; delivery expense, 3c; administrative expense, 9c; profit, 9c.

UNIT 8

INTEREST

CHAPTER 41

PRINCIPLES AND PROBLEMS

The term *interest* is used to describe the amount paid or received for the use of money. The one who uses the money of another pays for its use; hence, interest is a cost or an expense to the borrower and an income to the lender.

The amount borrowed, or the amount on which the interest is calculated, is known as the *principal*. The percentage of the principal to be paid each year for the use of the money is known as the *rate*. The *time* is the number of days, months, or years during which the money is to be used. The rate is based on one year; but if the borrower uses the money for more or less than a year, the amount of interest paid will be proportionally more or less.

By referring to the table on the next page, you will see the effect of the laws in the various states on interest rates. When a definite rate is fixed by state law, this is referred to as the *legal rate* and is the rate to be applied when no other rate has been fixed by contract. Some states allow a contract rate greater than the legal rate, but other states permit the legal rate only. Collecting more than the permitted rate of interest is referred to as *usury*.

Interest calculations require the percentage application of decimal fractions with the rate based on one year. If Robert Jones, a salesman, is to receive as a compensation 6% of the sales he makes, his income is .06 of his sales, or 6c on each dollar. If his income from money lent is 6%, he receives .06 of the amount lent, or 6c on each dollar, for each year the money is used by the one to whom it is lent. The calculations necessary to arrive at the compensation are the same in each case, provided the money lent is used by the borrower for a full year. If the borrower uses the money for less than a year, the compensation for its use will be less and will be computed for the fractional part of a year.

INTEREST RATES IN THE VARIOUS STATES

States and Territories	Legal Rate Per cent	Contract Rate Per cent	States and Territories	Legal Rate Per cent	Contract Rate Per cent
Alabama.....	8	8	Montana.....	8	10
Alaska.....	8	12	Nebraska.....	7	10
Arkansas.....	6	10	Nevada.....	7	12
Arizona.....	6	10	New Hampshire..	6	Any rate
California.....	7	12	New Jersey.....	6	6
Colorado.....	8	12	New Mexico.....	6	10
Connecticut.....	6	12	New York.....	6	6
Delaware.....	6	6	North Carolina..	6	6
Dist. of Col.....	6	8	North Dakota...	6	9
Florida.....	8	10	Ohio.....	6	8
Georgia.....	7	8	Oklahoma.....	6	10
Hawaii.....	8	12	Oregon.....	6	10
Idaho.....	7	10	Pennsylvania....	6	6
Illinois.....	5	7	Porto Rico.....	6	12
Indiana.....	6	8	Rhode Island....	6	Varies
Iowa.....	6	8	South Carolina...	7	8
Kansas.....	6	10	South Dakota....	7	10
Kentucky.....	6	6	Tennessee.....	6	6
Louisiana.....	5	8	Texas.....	6	10
Maine.....	6	Any rate	Utah.....	8	12
Maryland.....	6	6	Vermont.....	6	6
Massachusetts...	6	Varies	Virginia.....	6	6
Michigan.....	5	7	Washington.....	6	12
Minnesota.....	6	8	West Virginia....	6	6
Mississippi.....	6	8	Wisconsin.....	6	10
Missouri.....	6	8	Wyoming.....	7	10

When interest is calculated on the principal for the time the principal has been used, it is known as *simple interest*. Remember that simple interest is nothing more than percentage with a time element involved. Compare the following:

6% interest on \$100 for 1 year .06 of \$100 6% of \$100

EXERCISE No. 134, INTEREST AT 6% FOR ONE OR MORE MONTHS

Since a year is 12 months, interest for one month is $\frac{1}{12}$ of that for a year; for 14 months, $\frac{1}{6}$ more than that for a year; for 2 years and 9 months, $2\frac{3}{4}$ times that for one year. Contract or custom may affect the interpretation of *month* in interest calculations, but, unless the meaning is governed by contract or by special conditions, a month is usually regarded as one-twelfth of a year.

The illustration given below shows the method of calculating the interest on \$500 for 3 months at 6%.

\$500	The principal is multiplied by .06, and the product of \$30 is the interest for one year. Since three months are $\frac{1}{4}$ of a year, dividing the interest by 4 gives the interest for three months, or \$7.50. If the period had been seven months, the interest for a year would have been divided by 12 and multiplied by 7. Calculations are carried to four decimal places until the final answer. A fraction of more than one-half cent is then considered to be a full cent, and one of less than half a cent is dropped.
.06	
4) \$30.00	
\$7.50	

The following problems provide practice in interest calculation based on the rate of 6% a year. Each month is considered to be equivalent to one-twelfth of a year.

1	2
a. \$400.00 for 3 months	a. \$2,500.00 for 15 months
b. 250.00 for 6 months	b. 2,200.00 for 12 months
c. 100.00 for 3 months	c. 2,000.00 for 3 months
d. 600.00 for 2 months	d. 3,000.00 for 3 months
e. 500.00 for 4 months	e. 4,000.00 for 4 months
f. 750.00 for 12 months	f. 5,000.00 for 5 months
g. 60.00 for 6 months	g. 6,000.00 for 3 months
h. 150.00 for 4 months	h. 1,500.00 for 12 months
i. 350.00 for 12 months	i. 4,000.00 for 6 months
j. 90.00 for 6 months	j. 5,000.00 for 7 months

EXERCISE No. 135, INTEREST AT 6% FOR ONE OR MORE MONTHS

The following problems provide practice in interest calculation when the rate is 6% a year and a month is considered to be one-twelfth of a year.

1	2
a. \$315.45 for 3 months	a. \$5,123.45 for 14 months
b. 591.15 for 6 months	b. 2,145.65 for 9 months
c. 675.35 for 3 months	c. 8,125.55 for 6 months
d. 723.85 for 4 months	d. 3,456.75 for 8 months
e. 225.85 for 2 months	e. 4,567.25 for 3 months
f. 645.50 for 4 months	f. 6,024.35 for 7 months
g. 765.80 for 2 months	g. 9,210.10 for 1 month
h. 217.85 for 1 month	h. 1,245.90 for 2 months
i. 355.65 for 2 months	i. 5,216.75 for 5 months
j. 129.75 for 12 months	j. 3,150.85 for 6 months

EXERCISE No. 136, RATES OTHER THAN 6%

When the rate is more or less than 6%, the amount of interest is ascertained in the same manner as when the rate is 6%; that is, the principal is multiplied by the rate to ascertain the interest for one year, and the interest for one year is used as a basis for ascertaining the interest for the number of months during which the principal has been used.

The following problems provide practice in ascertaining the interest when the principal, the rate, and the number of months are given:

1	2
a. \$300, 4 mos., 5%	a. \$2,000, 8 mos., 5%
b. 500, 6 mos., 4%	b. 3,000, 7 mos., 5%
c. 300, 2 mos., 7%	c. 5,000, 5 mos., 5%
d. 800, 3 mos., 8%	d. 1,000, 9 mos., 9%
e. 60, 6 mos., 7%	e. 2,000, 2 mos., 8%
f. 900, 1 mo., 8%	f. 6,000, 6 mos., 4½%
g. 100, 6 mos., 9%	g. 2,000, 2 mos., 8%
h. 200, 8 mos., 7%	h. 3,000, 5 mos., 7%
i. 300, 3 mos., 3%	i. 2,000, 8 mos., 7%
j. 800, 4 mos., 4½%	j. 9,000, 9 mos., 4%

EXERCISE No. 137, INTEREST FOR ONE OR MORE MONTHS

The following problems provide practice in interest calculations when the principal, the rate, and the time in months are given, each year consisting of 12 months, and each month being $\frac{1}{12}$ of a year. The illustration below shows the method of calculating the interest on \$581.65 for 3 months at 7%.

$$\begin{array}{r} \$581.65 \\ 07 \\ \hline 4) \$40.7155 \\ \hline \$10.1788 \end{array}$$

The principal is multiplied by .07, and the product of \$40.7155 is the interest for one year. Dividing this by 4 gives a quotient of \$10.1788, or \$10.18, the interest for 3 months.

In all interest calculations carry the operations to four decimal places before discarding the remainders.

1	2
a. \$565.15, 6 mos., 5%	a. \$1,250.75, 7 mos., 5%
b. 75.65, 3 mos., 7%	b. 3,475.95, 2 mos., 9%
c. 323.50, 7 mos., 8%	c. 5,432.10, 3 mos., 7%
d. 439.65, 1 mo., 9%	d. 6,125.50, 7 mos., 4%

- | | |
|------------------------------------|--------------------------------------|
| e. 786.15, 6 mos., 7% | e. 4,050.25, 6 mos., 8% |
| f. 435.80, 1 mo., $4\frac{1}{2}\%$ | f. 2,254.35, 1 mo., $4\frac{1}{2}\%$ |
| g. 219.55, 3 mos., 5% | g. 6,250.85, 4 mos., 7% |
| h. 398.95, 4 mos., 7% | h. 4,125.65, 5 mos., 9% |
| i. 456.65, 5 mos., 8% | i. 4,450.55, 2 mos., 7% |
| j. 275.50, 7 mos., 3% | j. 3,130.30, 3 mos., 3% |

EXERCISE No. 138, INTEREST AT 6% FOR A NUMBER OF DAYS

When the time is less than a year and not an exact number of months, it is expressed in days. When the money is used for a designated number of days, it is necessary to use the number of days in a year in order to ascertain the fractional part of a year during which the money has been used. For convenience in interest calculations, it is customary in business to regard a year as 360 days, composed of 12 months of 30 days each. This means that 20 days are $\frac{20}{360}$ or $\frac{1}{18}$ of a year; 30 days, $\frac{30}{360}$ or $\frac{1}{12}$ of a year; 60 days, $\frac{60}{360}$ or $\frac{1}{6}$ of a year; 6 days, $\frac{6}{360}$ or $\frac{1}{60}$ of a year; etc.

When this reasoning is applied in determining the interest on \$200 for 90 days at 6%, the process is as follows: the interest on \$200 for one year at 6% is .06 times \$200, or \$12; 90 days are $\frac{90}{360}$ or $\frac{1}{4}$ of a year; $\frac{1}{4}$ of \$12 is \$3.

If \$200 had been used for 40 days, the interest would be $\frac{1}{9}$ of \$12, or \$1.33, because 40 days are $\frac{1}{9}$ of 360 days. If the \$200 had been used for 20 days, the interest would be 67c, because 20 days are $\frac{1}{18}$ of 360 days.

The following problems provide practice in ascertaining the interest at 6% when the time is expressed in days:

- | 1 | 2 | 3 |
|----------------------|------------------------|---------------------|
| a. \$300 for 60 days | a. \$1,200 for 12 days | a. \$22 for 60 days |
| b. 200 for 90 days | b. 2,250 for 20 days | b. 84 for 30 days |
| c. 450 for 30 days | c. 4,500 for 40 days | c. 36 for 20 days |
| d. 450 for 40 days | d. 7,500 for 80 days | d. 95 for 6 days |
| e. 200 for 30 days | e. 2,500 for 30 days | e. 49 for 12 days |
| f. 450 for 20 days | f. 3,900 for 40 days | f. 62 for 18 days |
| g. 800 for 40 days | g. 4,200 for 80 days | g. 65 for 90 days |
| h. 250 for 90 days | h. 6,000 for 60 days | h. 80 for 30 days |
| i. 375 for 20 days | i. 6,600 for 66 days | i. 75 for 20 days |
| j. 375 for 60 days | j. 7,200 for 72 days | j. 96 for 60 days |
| k. 300 for 40 days | k. 8,000 for 80 days | k. 72 for 12 days |
| l. 375 for 60 days | l. 3,600 for 36 days | l. 13 for 40 days |

EXERCISE No. 139, INTEREST AT 6% FOR A NUMBER OF DAYS

The following problems provide practice in ascertaining the interest when the time is expressed in days and the rate is 6%. The illustration given below shows the method of ascertaining the interest on \$282.45 for 45 days at 6%.

$$\begin{array}{r} \$282.45 \\ .06 \\ \hline \$16.9470 \end{array}$$

45 days = $\frac{45}{360}$ or $\frac{1}{8}$ of a year
 $\frac{1}{8}$ of \$16.9470 = \$2.1183, or
 \$2.12

The interest for one year is .06 of \$282.45, or \$16.9470, as shown in the solution at the left. 45 days are $\frac{45}{360}$ or $\frac{1}{8}$ of a year. If the interest on \$282.45 is \$16.9470 for one year, for $\frac{1}{8}$ of a year, it is $\frac{1}{8}$ of this amount, or \$2.12.

1

2

3

- | | | |
|----------------------|---------------------|-----------------------|
| a. \$299.75, 40 days | a. \$85.40, 54 days | a. \$2,311.55, 6 days |
| b. 377.16, 30 days | b. 99.18, 36 days | b. 3,265.70, 60 days |
| c. 704.45, 18 days | c. 52.40, 90 days | c. 2,291.90, 45 days |
| d. 199.25, 36 days | d. 78.65, 30 days | d. 4,402.11, 36 days |
| e. 462.75, 80 days | e. 15.50, 120 days | e. 9,841.40, 90 days |
| f. 281.90, 90 days | f. 77.75, 80 days | f. 7,208.16, 20 days |
| g. 616.65, 72 days | g. 36.85, 40 days | g. 3,303.48, 60 days |
| h. 109.14, 90 days | h. 82.65, 36 days | h. 2,908.65, 80 days |
| i. 200.20, 100 days | i. 62.95, 72 days | i. 8,414.15, 40 days |
| j. 411.15, 45 days | j. 44.88, 60 days | j. 7,209.19, 40 days |

EXERCISE No. 140, SIXTY-DAY 6% METHOD

In interest calculations 60 days are $\frac{60}{360}$, or $\frac{1}{6}$, of a year. If the interest rate is 6% a year, the interest rate for 60 days is $\frac{1}{6}$ of 6%, or 1%. Interest for 60 days at 6% may then be found by multiplying the principal by 1%, or .01, or, in other words, by pointing off two decimal places. Since 6 days are $\frac{1}{10}$ of 60 days, interest for 6 days at 6% may be found by multiplying the principal by .1%, or .001, or, in other words, by pointing off three decimal places.

Many interest calculations may involve a number of days which cannot be conveniently expressed as a fraction of a year, but which can be conveniently expressed as a fraction of 60 days. Since the interest for 60 days is known without any calculations, it is frequently advisable to use 60 days instead of 360 days as a basis for the fraction. For example, when the interest on \$300 for 30 days at 6% is to be found, the process is: the interest on \$300 for 60 days at 6% is \$3; 30 days = $\frac{30}{60}$ or $\frac{1}{2}$ of 60 days; the interest for 30 days is therefore $\frac{1}{2}$ of \$3, or \$1.50.

The interest on \$200 for 42 days at 6% is found as follows: the interest on \$200 for 60 days at 6% is \$2; 42 days = $\frac{42}{60}$ or $\frac{7}{10}$ of 60 days; $\frac{7}{10}$ of \$2 = \$1.40.

The interest on \$500 for 48 days at 6% is found as follows: the interest on \$500 for 60 days at 6% is \$5; 48 days = $\frac{48}{60}$ or $\frac{4}{5}$ of 60 days; $\frac{4}{5}$ of \$5 = \$4.

The following problems provide practice in ascertaining the interest at 6% for a number of days:

1	2	3
a. \$100 for 30 days	a. \$450 for 66 days	a. \$ 25 for 24 days
b. 150 for 45 days	b. 300 for 72 days	b. 35 for 36 days
c. 200 for 20 days	c. 400 for 80 days	c. 40 for 42 days
d. 300 for 40 days	d. 200 for 84 days	d. 75 for 36 days
e. 500 for 45 days	e. 900 for 90 days	e. 45 for 60 days
f. 300 for 36 days	f. 400 for 75 days	f. 100 for 40 days
g. 150 for 42 days	g. 600 for 85 days	g. 60 for 48 days
h. 300 for 12 days	h. 150 for 96 days	h. 48 for 72 days
i. 400 for 24 days	i. 250 for 66 days	i. 72 for 36 days
j. 800 for 30 days	j. 300 for 72 days	j. 36 for 42 days

EXERCISE No. 141, SIXTY-DAY 6% METHOD

When the time is more than 60 days, the interest for the additional days may be found by separating the additional days into aliquot parts of 60, and taking such fractional part of the interest for 60 days as the number of days is of 60 days. If the time is less than 60 days, the interest for the required number of days may be found by using the interest for 60 days as a basis. The illustration below shows the method of ascertaining the interest on \$726.48 at 6% for 85 days.

\$726.48 — 85 days

7.2648 = int. for 60 days

2.4216 = int. for 20 days

.6054 = int. for 5 days

10.2918 = int. for 85 days

or \$10.29

The interest for 60 days is ascertained by moving the decimal point two places to the left. The interest for 20 days is $\frac{20}{60}$ or $\frac{1}{3}$ of that for 60 days; and the interest for 5 days is $\frac{5}{60}$ or $\frac{1}{12}$ of that for 60 days. The interest on the given principal for 85 days at 6% is \$10.29, which is equal to the interest on this principal for 60 days plus 20 days plus 5 days. A fraction of a cent is

used until the final result is obtained. At that time it is regarded as a whole cent if it is one-half or more, or is discarded if it is less than one-half of a cent.

The following problems provide practice in ascertaining the interest at 6% on a given principal for a given number of days, when the calculations are based on the interest for 60 days.

This method is sometimes referred to as the "60-day method," which may be interpreted to mean that the interest for 60 days is used as a basis in ascertaining the interest for a given number of days. You are to show the necessary calculations arranged in the same form as that used in the illustration. Any fractional values desired may be used; thus, in the illustration, 15 days ($\frac{1}{4}$) and 10 days ($\frac{1}{6}$) could have been used instead of 20 days ($\frac{1}{3}$) and 5 days ($\frac{1}{12}$).

1	2	3
a. \$327.48, 45 days	a. \$154.55, 99 days	a. \$205.48, 16 days
b. 357.55, 30 days	b. 116.42, 120 days	b. 39.87, 98 days
c. 518.42, 15 days	c. 314.50, 75 days	c. 215.40, 95 days
d. 721.19, 20 days	d. 921.90, 125 days	d. 415.55, 77 days
e. 214.55, 12 days	e. 614.50, 77 days	e. 211.11, 12 days
f. 718.80, 45 days	f. 918.78, 79 days	f. 485.25, 42 days
g. 827.40, 30 days	g. 415.65, 92 days	g. 261.84, 47 days
h. 418.05, 20 days	h. 404.00, 96 days	h. 112.60, 57 days
i. 300.65, 48 days	i. 350.25, 98 days	i. 99.83, 35 days
j. 207.62, 36 days	j. 207.32, 88 days	j. 47.42, 92 days
k. 218.25, 18 days	k. 402.90, 91 days	k. 104.68, 12 days
l. 721.22, 15 days	l. 537.54, 45 days	l. 64.42, 48 days

EXERCISE No. 142, SIX-DAY 6% METHOD

The interest on any sum of money at 6% for 60 days can be ascertained by moving the decimal point two places to the left. Hence, the interest for 6 days at 6% can be ascertained by moving the decimal point three places to the left, because 6 is one-tenth of 60. To find the interest on any principal for any number of days, ascertain the interest for 6 days at 6% by moving the decimal point three places to the left; multiply this result by the quotient obtained by dividing the number of days by 6; the product is the interest on the given principal for the required number of days.

Based on the statements above, the interest on \$200 for 27 days is 90c: $.200 \times 4\frac{1}{2} (27 \div 6) = .90$ or 90c. The interest on \$500 for 39 days is \$3.25: $.500 \times 6\frac{1}{2} (39 \div 6) = \3.25 .

The following problems provide practice in finding the interest at 6% by using the 60-day method or the 6-day method. Use the method which you consider the shorter.

1	2	3
a. \$200 for 24 days	a. \$ 85 for 24 days	a. \$2,000 for 27 days
b. 150 for 18 days	b. 550 for 48 days	b. 1,000 for 39 days
c. 300 for 36 days	c. 75 for 66 days	c. 3,000 for 86 days
d. 400 for 42 days	d. 300 for 90 days	d. 2,500 for 72 days
e. 50 for 45 days	e. 250 for 51 days	e. 1,500 for 66 days
f. 25 for 66 days	f. 99 for 48 days	f. 900 for 9 days
g. 375 for 24 days	g. 150 for 72 days	g. 9,000 for 72 days
h. 250 for 42 days	h. 500 for 78 days	h. 8,500 for 24 days
i. 500 for 48 days	i. 250 for 72 days	i. 5,500 for 33 days
j. 300 for 51 days	j. 95 for 36 days	j. 4,000 for 40 days

EXERCISE No. 143, SIX-DAY 6% METHOD

The illustration below shows the method of ascertaining the interest on \$418.25 for 78 days at 6%, by the 6-day method, and of proving the result by the 60-day method.

a.	b.
$78 \div 6 = 13$	$78 \text{ days} = 60 + 12 + 6$
\$.41825 = interest for 6 days	4.1825 = interest for 60 days
13	.8365 = interest for 12 days
	.4182 = interest for 6 days
\$5.43725 = interest for 78 days	
	\$5.4372 = interest for 78 days

Solution (a) shows the 6-day method, and solution (b) shows the 60-day method. According to the 6-day method, 78 is divided by 6; and the principal, with the decimal point moved three places to the left, is multiplied by the quotient. According to the 60-day method, the interest for 60 days is the principal with the decimal point moved two places to the left. The interest for 12 days is $\frac{1}{5}$ of the interest for 60 days, and the interest for 6 days is $\frac{1}{2}$ of the interest for 12 days. The sum of the interest for 60, 12, and 6 days is \$5.44, the interest for 78 days.

The following problems provide practice in applying the 6-day 6% method as illustrated, and in proving the calculations by the 60-day method.

1	2	3
a. \$199.65, 51 days	a. \$55.40, 91 days	a. \$2,987.62, 59 days
b. 724.50, 69 days	b. 75.65, 38 days	b. 9,881.62, 49 days
c. 415.40, 33 days	c. 22.50, 102 days	c. 5,005.05, 92 days
d. 622.18, 81 days	d. 55.05, 78 days	d. 6,661.42, 17 days
e. 944.44, 21 days	e. 92.19, 57 days	e. 7,991.99, 74 days
f. 515.78, 27 days	f. 57.57, 45 days	f. 6,682.48, 65 days
g. 866.78, 99 days	g. 38.62, 93 days	g. 8,881.19, 11 days
h. 200.50, 45 days	h. 45.55, 87 days	h. 4,455.15, 95 days
i. 750.75, 84 days	i. 72.50, 78 days	i. 6,114.45, 46 days
j. 219.95, 48 days	j. 99.98, 96 days	j. 9,881.55, 39 days

EXERCISE No. 144, RATES OTHER THAN 6%

The 60-day method of calculating interest may be used even though the interest rate is not 6%. The solution given below shows the application of this method to the calculation of interest on \$421.60 for 69 days at 8%.

\$4.2160 = int. @ 6%, 60 days	In the solution at the left the interest
.4216 = int. @ 6%, 6 days	is found on the principal, \$421.60, for
.2108 = int. @ 6%, 3 days	the time, 69 days, at the rate of 6%.
	This amount is then divided by 6 to
\$4.8484 = int. @ 6%, 69 days	show the interest at the rate of 1%
.80806 = int. @ 1%, 69 days	and is multiplied by 8 to show the
\$6.46448 = int. @ 8%, 69 days	interest at the rate of 8%. You will
	observe that the fraction of a cent is
	not discarded until the final result is
	obtained.

The following problems provide practice in ascertaining interest at rates other than 6% by using the 60-day method as a basis:

1	2
a. \$721.65, 66 days, 7%	a. \$3,754.75, 94 days, 4%
b. 318.54, 49 days, 5%	b. 7,621.32, 72 days, 7%
c. 218.91, 66 days, 8%	c. 3,381.85, 51 days, 5%
d. 714.45, 84 days, 9%	d. 2,216.48, 72 days, 7%
e. 216.72, 24 days, 10%	e. 9,861.75, 99 days, 3%
f. 327.92, 44 days, 7%	f. 2,221.25, 45 days, $4\frac{1}{2}\%$
g. 216.65, 55 days, 4%	g. 8,962.75, 44 days, $4\frac{1}{2}\%$
h. 986.55, 55 days, 5%	h. 6,241.45, 63 days, 5%
i. 221.25, 42 days, 9%	i. 7,219.95, 98 days, 9%
j. 316.36, 27 days, $7\frac{1}{2}\%$	j. 4,454.45, 78 days, 7%

EXERCISE No. 145, CANCELLATION METHOD

When the rate is other than 6%, the cancellation method can sometimes be used to advantage in ascertaining the amount of interest. The interest is the quotient resulting from the principal multiplied by the number of days, multiplied by the rate, divided by 360, the number of days in a year. The illustration below shows the application of the cancellation method in ascertaining the interest on \$829.48 for 90 days at 7%.

$$\begin{array}{r}
 207.37 \\
 \hline
 \cancel{829.48} \times \cancel{90} \times .07 \\
 \hline
 \cancel{360} \\
 \cancel{4} \\
 \hline
 = 207.37 \times .07 = \$14.52
 \end{array}$$

The principal, the number of days, and the rate are written above the line; and the number of days in a year, below the line. 90 is contained into 360, 4 times; hence, the 90 is canceled and the 4 is written below the 360. 829.48 is divisible by 4; hence, the 4 is canceled and 207.37, the result obtained by dividing by 4, is written above 829.48. The numbers below the line are all canceled; hence, the product of $207.37 \times .07$ is the required interest.

The following problems provide practice in applying the cancellation method. You will show the solution by cancellation and the proof by either the 60-day method or the 6-day method.

- | 1 | 2 |
|--------------------------|--|
| a. \$315.17, 55 days, 7% | a. \$2,356.75, 18 days, 10% |
| b. 221.75, 40 days, 8% | b. 5,566.75, 12 days, 9% |
| c. 598.76, 54 days, 5% | c. 3,789.21, 54 days, 7% |
| d. 665.45, 90 days, 3% | d. 9,482.56, 90 days, 5% |
| e. 432.26, 75 days, 4% | e. 8,521.10, 75 days, 4% |
| f. 850.50, 80 days, 9% | f. 3,134.57, 80 days, $4\frac{1}{2}\%$ |
| g. 925.35, 30 days, 3% | g. 6,750.25, 24 days, 3% |
| h. 475.65, 45 days, 7% | h. 4,156.30, 48 days, 9% |
| i. 220.50, 70 days, 9% | i. 7,721.13, 50 days, 8% |
| j. 766.66, 50 days, 5% | j. 1,090.80, 55 days, 7% |

EXERCISE No. 146, TIME REQUIRED

In the solution of problems involving interest, it is necessary to ascertain the time during which the money has been in use in order to calculate the interest. There are two methods of ascertaining the time between two given dates: (a) by subtracting the beginning date from the ending date, or by what is known as compound subtraction; and (b) by counting the actual number of days between the two dates.

The illustration given below shows the method of ascertaining the time between March 16 and October 27 by compound subtraction. You will use this method only when instructed to do so.

$$\begin{array}{r}
 \text{Mo. Day} \\
 10 - 27 \\
 3 - 16 \\
 \hline
 7 - 11 \\
 7 \times 30 = 210 \text{ days} \\
 210 + 11 = 221 \text{ days}
 \end{array}$$

October is the tenth month and March is the third; hence, it is necessary to subtract three months and sixteen days from ten months and twenty-seven days. The difference is seven months and eleven days. It is customary to regard a year as twelve months of thirty days each. In seven months there are 210 days; adding the eleven days makes a total of 221 days,

the difference in time by compound subtraction.

The illustration below shows the method of ascertaining the time by counting the actual number of days between the two dates. You will use this method in solving problems, unless you are specifically instructed to ascertain the time by compound subtraction.

March, the first month, has thirty-one days, but the interest does not begin until the sixteenth of March; hence, sixteen is subtracted from thirty-

Mar. 31 days	one leaving a balance of fifteen days. To this is added
Mar. 16	the number of days in each of the succeeding months
—	and the twenty-seven days in October. The reason
15	the time by actual count is more than that by the
Apr. 30	other method is that some of the months have thirty-
May 31	one days. Because of the fact that all the months do
June 30	not have the same number of days, it is customary to
July 31	count the number of days by this method.
Aug. 31	Since the tendency in modern business is to ascer-
Sept. 30	tain the time by counting the actual number of days,
Oct. 27	your interest calculations should be based on the
—	actual number of days, unless you are instructed to
225	use another method.

The following problems provide oral practice in ascertaining the time between two given dates. You are to state the mental process of ascertaining the time in each problem.

1

- | | |
|------------------------------|-------------------------------|
| a. May 10 to June 5 | g. September 16 to October 16 |
| b. November 6 to January 4 | h. March 1 to April 10 |
| c. October 7 to November 9 | i. January 5 to February 11 |
| d. July 1 to July 28 | j. November 9 to December 23 |
| e. July 16 to August 16 | k. May 18 to August 12 |
| f. August 16 to September 16 | l. May 12 to May 20 |

2

- | | |
|------------------------------|------------------------------|
| a. June 15 to July 6 | g. May 16 to May 29 |
| b. August 7 to September 9 | h. April 1 to May 10 |
| c. May 4 to May 25 | i. May 11 to June 10 |
| d. February 9 to February 28 | j. July 6 to August 3 |
| e. March 16 to April 1 | k. November 9 to June 1 |
| f. July 1 to July 12 | l. January 11 to February 20 |

EXERCISE No. 147, TIME AND INTEREST REQUIRED

The illustration given below shows one method of ascertaining the interest on \$425.50 from April 5 to June 13 at 6% and another method of proving this solution.

Apr. 30	a. 425.50 at 6% for 6 days = .42550	b. 4.2550 = int. for 60 days
Apr. 5	69 ÷ 6 = 11½	.4255 = int. for 6 days
25	.42550 × 11½ = \$4.89	.2127 = int. for 3 days
May 31		4.8932 = int. for 69 days
June 13		or \$4.89
69		

In solution (a) the six-day 6% method is used. The interest on the principal for six days is ascertained by moving the decimal point three places to the left. The interest for the desired number of days is ascertained by multiplying the interest for six days by 11½.

The proof shown in illustration (b) is based on the sixty-day method. The number of days is divided into sixty, six, and three, and the interest is ascertained by the process explained previously. You should always prove your solution by applying a different method.

The following problems provide practice in: (a) ascertaining the time between two given dates; and (b) ascertaining the interest on a stated amount for this time. Use the 60-day method or the 6-day method in ascertaining the interest, and the cancellation method in proving your result.

- ✓1. \$ 275.65 from June 9 to November 12 at 6%
2. 741.50 from March 3 to June 16 at 6%
- ✓3. 5,000.00 from May 15 to October 21 at 5%
4. 118.62 from November 5 to February 28 at 6%
- ✓5. 10,000.00 from March 1 to October 1 at 4½%
6. 12.50 from June 16 to November 3 at 6%
- ✓7. 211.11 from April 9 to October 12 at 6%
8. 2,500.00 from July 1 to January 1 at 5%
- ✓9. 44.55 from May 9 to November 9 at 6%
10. 71.75 from May 17 to June 21 at 6%

EXERCISE No. 148, PROBLEMS IN INTEREST

1. Crocker & Company borrowed from the City National Bank \$5,000 on their note, dated June 1, with interest at the rate of 6%. The note and the interest were paid on July 31. Find the amount paid the bank at the maturity of the loan.

2. On September 10 the Wells Fargo Bank made a loan of \$2,000 to the Southern Publishing Company at 7% interest. A 90-day note was given. The bank deducted the interest for the time and gave the publishing company a draft for the net amount. Find the net amount of the loan.

3. A broker charged his client $6\frac{1}{2}\%$ interest on \$1,200 to be repaid at the end of 6 months. What was the amount paid the broker at the maturity of the loan?

4. A loan of \$300, made on February 5, was to run 3 months and to carry interest at 8%. Find the date of maturity and the amount of interest.

5. Smith Brothers owed a bill for goods amounting to \$658, due on August 15 and bearing 6% interest after the due date. The bill and the interest were paid on October 29. Find the total amount paid.

6. In order to finish his college course, a student borrowed \$1,000 from a friend on September 1, to be paid $3\frac{1}{2}$ years later with 5% interest. What was the amount of the check, including the loan and the interest?

7. The federal government retired 20-year bonds to the amount of \$2,000,000, on which $3\frac{1}{2}\%$ interest had been paid each year. Calculate the amount of interest for the 20-year period.

8. A 90-day loan of \$150 was due on November 9. By agreement the loan was extended to December 9. On December 9 what was the amount of the check given for the loan plus 6% interest? What was the date of the loan?

9. Find the interest on the following loan: \$1,500; date, January 30; maturity, April 15; rate, $5\frac{1}{2}\%$.

10. Find the interest on each of the following loans:

	Principal	Time	Rate		Principal	Time	Rate
a.	\$ 265.50	45 days	4%	f.	\$1,375.00	66 days	$6\frac{1}{2}\%$
b.	329.10	72 "	$4\frac{1}{2}\%$	g.	2,400.00	90 "	7%
c.	790.00	75 "	5%	h.	1,650.00	3 mos.	$7\frac{1}{2}\%$
d.	165.20	36 "	$5\frac{1}{2}\%$	i.	725.00	18 "	6%
e.	260.00	60 "	6%	j.	390.00	30 days	3%

CHAPTER 42

ACCURATE INTEREST

As a rule, when calculating interest, business men and bankers consider a year to be 360 days. This custom facilitates the calculations required to find the interest when the time is expressed in days. The actual number of days in a year are sometimes used in calculating interest. When interest is reckoned on a basis of 365 days to an ordinary year and 366 days to a leap year, it is referred to as *accurate* or *exact* interest.

The illustrations given below show the calculations necessary to secure the interest on \$721.68 for 48 days at 6% by the 6-day, 6% method (at the left) and by accurate interest (at the right).

		When the accurate interest is	
$48 \div 6 = 8$		desired, the principal is multiplied	\$721.68
\$.72168 = int. for 6 days	by the rate expressed as a decimal	fraction. The product is the inter-	.06
8	est for one year. This amount	is then multiplied by the number	<u>43.3008</u>
	of days for which interest is to be	calculated, 48, and is divided by	48
\$5.77344 = interest for	the exact number of days in the year, 365. The accurate		<u>3464064</u>
48 days	interest is found to be \$5.69; while the interest by the 6-day,		1732032
	6% method is found to be \$5.77. Exact interest, in the cal-		<u>\$2078.4384</u>
	culation of which 365 days are considered to be a year, is		
	always less than banker's interest (Interest calculated on		\$5.6943
	a basis of 360 days in a year is commonly called banker's		365)\$2078.4384
	interest because bankers ordinarily use this method). 365		<u>1825</u>
	days are $\frac{5}{360}$, or $\frac{1}{72}$, greater than 360 days. Banker's inter-		2534
	est is therefore $\frac{1}{72}$ greater than the accurate interest,		<u>2190</u>
	and the accurate interest is $\frac{1}{72}$ less than the banker's in-		3443
	terest.		<u>3285</u>
			1588
			<u>1460</u>
			1284
			<u>1095</u>

EXERCISE No. 149, ACCURATE OR EXACT INTEREST

The following problems provide practice in ascertaining accurate interest. You will show: (a) the calculations necessary to find the time by counting the actual number of days; and (b) the accurate interest for this time on the given principal at the specified rate.

1. Interest on \$1,560 at 4% from March 18 to December 9 of the same year.
2. Interest on \$960.65 at 6% from June 30 to September 20 of the same year.
3. Interest on \$5,000 at 8% from November 2 of one year to January 15 of the following year.
4. Interest on \$650 at 8% from October 14 to December 27 of the same year.
5. Interest on \$2,400.24 at $4\frac{1}{2}\%$ from August 23 of one year to March 20 of the following year (February, 28 days).
6. Interest on \$1,741.50 at 6% from July 29 to September 11 of the same year.
7. Interest on \$975.50 at 6% from January 3 to March 1 of the same year (February, 28 days).
8. Interest on \$800 at 5% from December 18 of one year to April 14 of the following year (February, 28 days).
9. *Interest on \$22,500 at 6% from January 10 of one year up to and including July 1 of the following year (February, 29 days).

*NOTE: Count the time from January 10 of one year, up to and including January 10 of the following year, as one full year. The actual number of days of the remaining time is the time for which accurate interest is to be computed.

EXERCISE No. 150, REVERSING THE OPERATIONS

There are four elements involved in interest calculations: (a) the principal, (b) the rate, (c) the time, and (d) the interest. If any three of these elements are provided, the fourth can be obtained. The process may be explained as follows:

- a. $\text{Principal} \times \text{rate for given time} = \text{interest}$
- b. $\text{Interest} \div (\$1 \times \text{rate for given time}) = \text{principal}$
- c. $\text{Interest} \div (\text{principal} \times \text{rate for 1 day}) = \text{time (in days)}$
- d. $\text{Interest} \div (\text{principal} \times 1\% \text{ for given time}) = \text{rate used}$

By substituting figures for the above, you have:

- a. $\$1,260 \text{ at } 5\% \text{ for } 54 \text{ days} = \9.45
- b. $\$9.45 \div .007\frac{1}{2} \text{ (interest on } \$1 \text{ for } 54 \text{ days at } 5\%) = \$1,260$
- c. $\$9.45 \div .17\frac{1}{2} \text{ (interest on } \$1,260 \text{ for } 1 \text{ day at } 5\%) = 54 \text{ days}$
- d. $\$9.45 \div \$1.89 \text{ (interest on } \$1,260 \text{ for } 54 \text{ days } 1\%) = 5\%$

One day is used as the basis when the time is to be determined, and \$1 is used as the basis when the principal is to be ascertained.

The following problems provide practice in ascertaining one of the elements when the other three are given. Ascertain the information required in the columns in which the question marks appear.

PRINCIPAL	RATE	TIME	INTEREST
✓1. \$ 800.00	7 %	4 mo., 3 days	? 19.13 ¹ / ₂
2. ?	6 %	3 mo., 3 days	\$ 32.55
3. 325.50	?	11 mo., 9 days	24.52
✓4. 4,500.00	4½ %	? 312	175.50
5. 1,846.24	7½ %	1 mo., 5 days	?
✓6. ? 672	5 %	33 days	3.08
✓7. 825.00	? 80	54 days	9.90
8. 960.00	5 %	?	18.80
9. ?	4 %	27 days	2.25
10. 360.00	8 %	2 mo., 6 days	?

CHAPTER 43

COMPOUND INTEREST

When a contract specifies that the accrued interest at the end of a designated period is to be added to the principal, and the interest for the next period is to be calculated on the new principal, the interest is said to be compounded and is called *compound interest*. The word *compound* before *interest* does not change the meaning of the latter term, but simply refers to a method of ascertaining the amount of interest. The contract will determine the length of each interest period. Thus, the period may be monthly, quarterly, semi-annual, or annual as the contracting parties may agree. The calculations below show how to ascertain the amount of interest on a \$5,000 note, dated January 1, due in one year, with interest at 6% to be compounded quarterly.

Principal, first quarter, \$5,000
Interest on \$5,000 for $\frac{1}{4}$ year = \$75
Principal, second quarter, \$5,075
Interest on \$5,075 for $\frac{1}{4}$ of a year = \$76.13
Principal, third quarter, \$5,151.13
Interest on \$5,151.13 for $\frac{1}{4}$ of a year = \$77.27
Principal, fourth quarter, \$5,228.40
Interest on \$5,228.40 for $\frac{1}{4}$ of a year = \$78.43
Amount due January 1, \$5,306.83

The principal for the first quarter is \$5,000. Beginning with April 1, however, it is increased by the interest on the principal for a quarter; hence, during the second quarter the principal is \$5,075. Beginning with July 1, the principal is increased by the interest on the principal for the second quarter, or one-fourth of a year. The same plan is followed for the third and fourth quarters. You will observe that the difference between the compound and the simple interest for this period is \$6.83.

EXERCISE No. 151, COMPOUND INTEREST

The following problems provide practice in ascertaining the amount of interest when the interest is to be compounded at stated periods. When the period for compounding is less than a

year, you may regard it as a fractional part of a year. Thus, the interest for 1 month would be $\frac{1}{12}$ of the interest for a year; for a quarter, $\frac{1}{4}$ of the interest for a year; for six months, $\frac{1}{2}$ of the interest for a year; etc.

	<i>Principal</i>	<i>Rate</i>	<i>Time</i>	<i>Compounded</i>
1.	\$ 313.20	6%	1 year	Quarterly
2.	200.50	4%	2 years	Semi-annually
3.	1,050.00	3%	3 years	Annually
4.	725.80	6%	2 years	Semi-annually
5.	5,000.00	5%	1 year	Quarterly
6.	460.20	8%	1 year	Monthly
7.	10,000.00	4½%	3 years	Annually
8.	375.80	7%	1 year	Monthly
9.	1,500.00	5%	5 years	Annually
10.	10,000.00	4%	4 years	Semi-annually
11.	2,000.00	6%	2 years	Quarterly
12.	3,500.00	4½%	4 years	Annually
13.	2,000.00	6%	1 year	Quarterly
14.	186.75	6%	1 year	Quarterly
15.	20,000.00	3%	10 years	Annually

EXERCISE No. 152, COMPOUND INTEREST TABLES

The table on page 207 shows the amount of \$1.00 compounded annually at 3%, 4%, 5%, 6%, 7%, 8%, and 10% for 40 years. The use of this table is illustrated below. The calculations refer to the interest on \$5,000, compounded annually at 5% for a period of 5 years.

Amount of \$1.00 after 5 years (see table) = 1.2762816

$\$5,000 \times 1.2762816 = \$6,381.41$, the amount of \$5,000 at the end of 5 years
 $\$6,381.41 - \$5,000 = \$1,381.41$, the compound interest

The following problems provide practice in using the information given in the compound interest table on page 207. You will arrange your calculations in the same order as in the illustration.

1

- | | |
|--------------------------|--------------------------|
| a. \$ 2,500, 5 years, 6% | f. \$ 9,500, 8 years, 4% |
| b. 1,800, 9 years, 3% | g. 2,100, 7 years, 5% |
| c. 100, 20 years, 8% | h. 50, 31 years, 6% |
| d. 500, 6 years, 7% | i. 2,000, 10 years, 8% |
| e. 30,000, 40 years, 8% | j. 3,500, 7 years, 7% |

2

- a. \$25,000, 15 years, 4%

b. 400, 9 years, 8%

c. 3,750, 12 years, 5%

d. 450, 4 years, 10%

e. 7,000, 5 years, 5%
- f. \$ 2,250, 12 years, 6%

g. 4,275, 9 years, 8%

h. 2,175, 21 years, 5%

i. 10,000, 10 years, 4%

j. 2,500, 35 years, 7%

COMPOUND INTEREST TABLE

The following table shows what \$1.00 will amount to at compound interest, at various rates per cent in any number of years, from 1 to 40 inclusive.

Yrs.	3 Per cent	4 Per cent	5 Per cent	6 Per cent	7 Per cent	8 Per cent	10 Per cent	Yrs.
1	1.0300 0000	1.0400 0000	1.0500 000	1.0600 000	1.0700 000	1.0800 000	1.1000 000	1
2	1.0609 0000	1.0816 0000	1.1025 000	1.1236 000	1.1449 000	1.1664 000	1.2100 000	2
3	1.0927 2700	1.1248 6400	1.1576 250	1.1910 160	1.2250 430	1.2597 120	1.3310 000	3
4	1.1255 0881	1.1698 5856	1.2155 063	1.2624 770	1.3107 960	1.3604 890	1.4641 000	4
5	1.1592 7407	1.2166 5290	1.2762 816	1.3382 256	1.4025 517	1.4693 281	1.6105 100	5
6	1.1940 5230	1.2653 1902	1.3400 956	1.4185 191	1.5007 804	1.5868 743	1.7715 610	6
7	1.2298 7387	1.3159 3178	1.4071 004	1.5036 303	1.6057 815	1.7138 243	1.9487 171	7
8	1.2667 7008	1.3685 6905	1.4774 554	1.5938 481	1.7181 862	1.8509 302	2.1435 888	8
9	1.3047 7318	1.4233 1181	1.5513 282	1.6894 790	1.8384 592	1.9990 046	2.3579 477	9
10	1.3439 1638	1.4802 4428	1.6288 946	1.7908 477	1.9671 514	2.1589 250	2.5937 425	10
11	1.3842 3387	1.5394 5406	1.7103 394	1.8982 986	2.1048 520	2.3316 390	2.8531 167	11
12	1.4257 6089	1.6010 3222	1.7858 563	2.0121 965	2.2521 916	2.5181 701	3.1384 284	12
13	1.4685 3371	1.6650 7351	1.8556 491	2.1329 283	2.4098 450	2.7196 237	3.4522 712	13
14	1.5125 8972	1.7316 7645	1.9799 816	2.2609 040	2.5785 342	2.9371 696	3.7974 983	14
15	1.5579 6742	1.8009 4351	2.0789 282	2.3965 582	2.7590 315	3.1721 691	4.1772 482	15
16	1.6047 0644	1.8729 8125	2.1828 746	2.5403 517	2.9521 638	3.4259 426	4.5949 730	16
17	1.6528 4763	1.9479 0050	2.2920 183	2.6927 728	3.1588 152	3.7000 181	5.0544 703	17
18	1.7024 3306	2.0258 1652	2.4066 192	2.8543 392	3.3799 323	3.9960 195	5.5599 173	18
19	1.7535 0605	2.1068 4913	2.5269 502	3.0255 995	3.6165 275	4.3157 011	6.1159 390	19
20	1.8061 1123	2.1911 2314	2.6532 977	3.2071 355	3.8696 845	4.6609 571	6.7275 000	20
21	1.8602 9457	2.2787 0807	2.7859 626	3.3995 636	4.1405 624	5.0338 337	7.4002 499	21
22	1.9161 0341	2.3699 1979	2.9252 607	3.6035 374	4.4304 017	5.4365 404	8.1402 749	22
23	1.9735 8651	2.4647 1555	3.0715 238	3.8197 497	4.7405 209	5.8714 637	8.9453 024	23
24	2.0327 9111	2.5633 0417	3.2250 999	4.0489 346	5.0723 670	6.3411 807	9.8497 327	24
25	2.0937 7247	2.6658 3633	3.3863 549	4.2918 707	5.4274 326	6.8484 752	10.8347 059	25
26	2.1565 9127	2.7724 6979	3.5556 727	4.5493 830	5.8073 529	7.3963 532	11.9181 765	26
27	2.2212 8901	2.8833 6858	3.7334 563	4.8223 459	6.2138 676	7.9880 615	13.1099 942	27
28	2.2879 2768	2.9987 0332	3.9201 291	5.1116 867	6.6488 384	8.6271 064	14.4209 936	28
29	2.3565 6551	3.1186 5145	4.1161 356	5.4183 879	7.1142 571	9.3172 749	15.8630 930	29
30	2.4272 6247	3.2433 9751	4.3219 424	5.7434 912	7.6122 550	10.0626 569	17.4494 023	30
31	2.5000 8035	3.3731 3341	4.5380 395	6.0881 006	8.1451 129	10.8676 694	19.1943 425	31
32	2.5750 8276	3.5080 5875	4.7649 415	6.4533 867	8.7152 708	11.7370 830	21.1137 768	32
33	2.6523 3524	3.6483 8110	5.0031 885	6.8405 899	9.3253 398	12.6760 496	23.2251 544	33
34	2.7319 0530	3.7943 1634	5.2533 480	7.2510 253	9.9781 135	13.6901 336	25.5476 699	34
35	2.8138 6245	3.9460 8899	5.5160 154	7.6860 868	10.6765 815	14.7853 443	28.1024 369	35
36	2.8982 7833	4.1039 3255	5.7918 161	8.1472 520	11.4239 422	15.9681 718	30.9126 805	36
37	2.9852 2668	4.2680 8986	6.0814 069	8.6360 871	12.2236 181	17.2456 256	34.0039 486	37
38	3.0747 8348	4.4388 1345	6.3854 773	9.1542 524	13.0792 714	18.6282 756	37.4043 434	38
39	3.1670 2698	4.6163 6599	6.7047 512	9.7035 075	13.9948 204	20.1152 977	41.1447 778	39
40	3.2620 3779	4.8010 2063	7.0399 857	10.2857 179	14.9744 578	21.7245 215	45.2592 556	40

CHAPTER 44

INSTALLMENTS AND INTEREST ON ACCOUNTS RECEIVABLE

When merchandise is bought on the installment plan, the purchaser pays a part of the price when the purchase is made and the remainder in equal installments, usually monthly. It is customary for the merchant to collect interest on the unpaid balance at the time each monthly payment is collected. This practice has the same effect as compound interest and permits the merchant to secure a monthly compensation for the use of his money, instead of waiting until the contract ends.

On July 1 J. C. Shook purchased a piano from the Star Piano Company for \$900. He paid \$300 in cash and the balance in monthly installments of \$100 with interest at 6%.

The payments on this piano, when the account was closed on January 1 of the following year, appeared as follows:

July 1, Due, \$600
Interest for July on \$600 = \$3
August 1, Due, \$603
August 1, Cash received, \$103
Interest for August on \$500 = \$2.50
September 1, Due, \$502.50
September 1, Cash received, \$102.50
Interest for September on \$400 = \$2
October 1, Due, \$402
October 1, Cash received, \$102
Interest for October on \$300 = \$1.50
November 1, Due, \$301.50
November 1, Cash received, \$101.50
Interest for November on \$200 = \$1
December 1, Due, \$201
December 1, Cash received, \$101
Interest for December on \$100 = \$.50
January 1, Due, \$100.50
January 1, Cash received, \$100.50

NOTE: Each month is treated as 30 days, and the interest is calculated by the 60-day method.

The following problems provide practice in calculating interest on deferred or installment payments.

1. On March 1 The Music Shop sold Robert Downing a phonograph for \$375. Mr. Downing paid \$75 in cash and was to pay the balance in monthly installments of \$25, with 6% interest on the balance payable on the first of the month. You are to show a record of the transactions with Mr. Downing and the amount of each payment.

2. On May 1 J. L. Jones purchased from the Citizens Motor Car Company a used automobile for \$1,000. He paid \$400 in cash and the balance in monthly installments of \$100 with interest at 6% on the balance payable on the first of the month. Show a record of the transactions and the amount of each payment.

3. On May 12 C. C. Maynard purchased from the Doyle Realty Company a house and lot for \$10,000. He paid \$2,000 in cash and executed sixteen notes for \$500 each, due on November 12 and May 12 respectively of each year. He also executed sixteen notes for interest. The first interest note was due November 12 and was for interest on \$8,000 at 6% for six months; the second interest note was due May 12 of the following year and was for interest on \$7,500 at 6% for six months; the third interest note was due on the following November 12 and was for interest at 6% on \$7,000 for six months. The other interest notes were for the interest due at the time of each semi-annual payment. You are to find the face of each interest note.

4. On March 16 E. H. Love purchased a piano from the Baldwin Piano Company for \$2,100. He paid \$300 in cash and was allowed a credit of \$600 on his used piano accepted in exchange. The balance was to be paid in monthly installments of \$100 each. At the time each monthly payment was made, Mr. Love was to pay, in addition to the \$100, interest on the balance at 6% for one month, a month to be regarded as $\frac{1}{12}$ of a year. No interest was to be charged on the balance until May 1, interest beginning on that date; and the first installment was to be paid on June 1. Find the amount of each monthly installment.

5. On June 17 O. A. Muir purchased a piano from the Wurlitzer Piano Company for \$1,500. He paid \$300 in cash and agreed

to pay the balance of \$1,200 in monthly installments of \$50 each. At the time he paid each monthly installment, he was also to pay interest on the balance at 6% for $\frac{1}{12}$ of a year. The first monthly installment was due August 1, at which time he paid interest for one month on \$1,200. He paid the required monthly installment and interest on August 1, September 1, and October 1. On November 1 he paid \$200 and the required interest; on December 1, \$150 and the required interest; and on January 1, the balance due on the piano and the interest. You are to find the balance due on January 1.

6. On March 1 Joseph A. Smith purchased a house and lot from the Brown Real Estate Company for \$12,500. He paid \$2,500 in cash and executed four notes of \$2,500 each, due in three, six, nine, and twelve months respectively; and four notes for the interest at 6% due at the same time as the notes for the principal. The contract provided that Mr. Smith might pay as much as he desired in excess of \$2,500 at the maturity of any of the notes, and that proper credit was to be made on the interest notes affected. On June 1 he paid the first \$2,500 note, the first interest note, and \$500 on the note maturing on September 1. On September 1 he paid the interest note due, less the proper credit; the balance of the second note; and \$2,000 on the third note. On December 1 he paid the balance of the third note, the balance of the interest due on this note, and \$2,000 on the fourth note. You are to show: (a) the amount of each of the four interest notes; (b) the amount of the credit due on the second interest note because of the excess payment on June 1; (c) the amount of the credit on the third interest note because of the excess payment on September 1; (d) the amount of the credit on the fourth interest note because of the excess payment on December 1; and (e) the amount paid on March 1.

Prepare the eight notes and make the credits as the payments are made. This project will help you in solving this problem and others like it, which occur quite frequently in business because of the deferred-payment plan of selling real estate.

EXERCISE No. 153, ACCOUNTS RECEIVABLE

The merchant sells merchandise for cash and on account. A sale *on account* means that the customer to whom the merchandise is sold will pay for it either at a stated time or on the

first of the following month. The *due date* of the sale is indicated on the invoice sent to the customer at the time the merchandise is shipped or delivered to him. *Net 30 days* written as the terms indicates that the due date is 30 days from the date of the invoice; *net 60 days*, that the invoice is due 60 days from the date of the invoice. If no time is stated in the terms, it is understood that the customer is to make payment on the first of the following month.

The illustration below shows, in account form, a record of the transactions with C. H. Middleton, as it appears in the ledger of the Davis Company. The figures on the left of the double line in the center of the account refer to sales, and those on the right of the line indicate the cash received from Mr. Middleton.

C. H. MIDDLETON

19—					19—		
Mar.	1	30 days	287 60	April	1	Cash	200
	10	60 days	194 85	June	1	Cash	100
April	7	60 days	513 38	Aug.	1	Cash	300
May	2	90 days	407 20				

If Mr. Middleton wishes to pay this account in full on September 1, and it is agreed that he should pay interest on past-due invoices, the custom is to add to the amounts on the left side of the account interest from the due date of each invoice up to and including the date of settlement, and to add to the amounts on the right side interest from the date of each payment up to and including the date of settlement. The balance of the account is the difference between the total sales plus interest and the total payments received from the customer plus interest.

If Mr. Middleton does pay this account on September 1, and he agrees to pay interest on the past-due invoices at 6%, the method of finding the amount he owes is illustrated below.

Interest on \$287.60 from March 31 to September 1, 154 days, is \$7.38.

Interest on \$194.85 from May 9 to September 1, 115 days, is \$3.73.

Interest on \$513.38 from June 6 to September 1, 87 days, is \$7.44.

Interest on \$407.20 from July 31 to September 1, 32 days, is \$2.17.

Interest on \$200 from April 1 to September 1, 153 days, is \$5.10.

Interest on \$100 from June 1 to September 1, 92 days, is \$1.53.

Interest on \$300 from August 1 to September 1, 31 days, is \$1.55.

Total of the left side, \$1,403.03, + the interest, \$20.72, = \$1,423.75.

Total of the right side, \$600, + the interest, \$8.18, = \$608.18.

Balance due, September 1 = \$815.57.

You will observe that the due date of an invoice is ascertained by adding to the date of the invoice the number of days before the invoice must be paid. In other words, the invoice is past due the day after the due date.

The following problems in account form provide practice in applying the use of interest in settling accounts.

1. C. J. LAWSON

19—					19—				
Aug.	7	60 days	185	15	Oct.	1	Cash	200	15
Aug.	31	30 days	207	55	Nov.	1	Cash	150	75
Sept.	12	60 days	81	25	Dec.	1	Cash	300	25
Sept.	25	30 days	322	50					
Oct.	19	60 days	406	21					

Ascertain the amount due on January 1 if interest at 6% is to be collected.

2. W. B. WIBERLING

19—					19—				
Jan.	2	60 days	321	20	Mar.	1	Cash	321	20
Feb.	12	60 days	255	40	April	1	Cash	150	40
April	19	60 days	422	75	June	1	Cash	100	60
May	31	60 days	718	91	June	18	Cash	422	75
July	25	60 days	275	55	Sept.	1	Cash	350	25
Sept.	10	60 days	192	90	Oct.	1	Cash	100	60
Oct.	1	60 days	255	07	Dec.	1	Cash	100	80

Ascertain the balance due on January 1 if interest at 6% is to be collected.

3. A. L. FIELD

19—					19—				
July	2		39	87	Aug.	1	Cash	250	30
July	12		142	50	Sept.	1	Cash	250	50
July	20		78	91	Oct.	1	Cash	100	25
July	31		107	36	Nov.	1	Cash	100	75
Aug.	9		151	75					
Aug.	25		172	36					
Sept.	20		202	32					

You are to ascertain the balance due on December 1, assuming that each invoice was due on the first of the month following the sale and that interest is to be collected at the rate of $5\frac{1}{2}\%$.

4. J. C. BARCLAY

19—					19—				
Mar.	7	30 days	250	15	April	6	Cash	250	15
April	10	30 days	327	50	May	1	Cash	150	90
May	25	30 days	500	35	June	1	Cash	200	85
June	17	30 days	181	25	July	1	Cash	100	60

You are to ascertain the balance due on September 1 if interest at 8% is to be collected.

CHAPTER 45

BANK LOANS

The principal income of a bank is the interest received for the use of the money which belongs to the bank or to its depositors, who have left it with the bank for safe-keeping. The interest earned by a bank does not differ from the interest earned by an individual; it is income earned through the use of money lent.

The method of ascertaining the time for which the money has been used is usually the same when the money is lent by a bank as when it is lent by an individual. The time is the number of days the money has been used. The day on which the money is borrowed is not considered, but the day on which it is paid or the loan is renewed is counted. Loans are made by banks for only a short time, usually 30, 60, or 90 days. Some banks collect the interest in advance, whereas others collect it at maturity; but either practice does not change the amount of the interest.

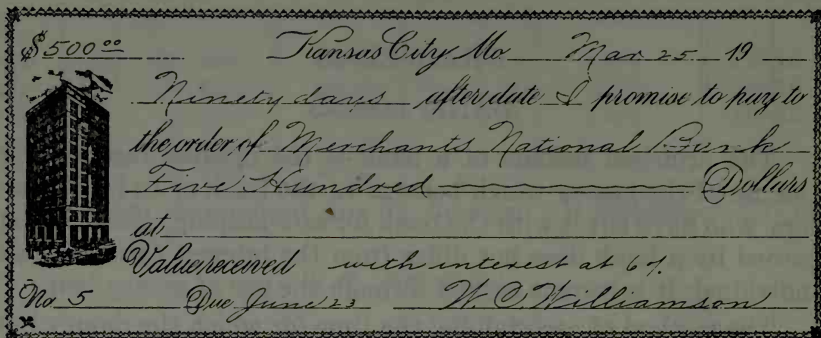
The bank will require a written evidence of a loan. This is usually in the form of a promissory note or an accepted draft. A promissory note is illustrated on page 214; an accepted draft is illustrated on page 227.

The *face* of a note is the amount stated in it. The *maturity value* is the amount that can be collected at maturity. A note containing the words *with interest* is interest-bearing; if the words *with interest* are not contained in the note, it will not bear interest until after maturity.

The maturity value of a \$500 non-interest-bearing note, dated May 23 and due in 90 days, is \$500 on August 21. The face value of the note up to and including August 21 is \$500. If the legal rate of interest in the state in which the note was executed is 6%, the face value of this note, 30 days after maturity, will be \$502.50; 60 days after maturity, it will be \$505.

The maturity value of an interest-bearing note is the face plus the interest at maturity. This is also referred to as the *amount* of the note. An interest-bearing note bears interest to maturity at the contract rate specified in the note, and thereafter at the legal rate in the state in which the note was issued.

The face of a \$500, 6% interest-bearing note, dated June 10 and due in 90 days, is \$500. The maturity value is \$507.50, the face of the note plus \$7.50 interest.



This note may be interpreted as follows: W. C. Williamson, known as the *maker*, borrowed \$500 from the Merchants National Bank, the *payee*, on March 25 and agreed to pay the \$500 with 6% interest 90 days from the date he borrowed it, or on June 23. Mr. Williamson will pay the bank \$507.50 on June 23, the \$500 he borrowed and \$7.50 interest for its use.

A business concern desiring a loan is given a credit rating, based on the net value of the property owned by the business and the financial standing of the business. Member banks of the Federal Reserve System are required to have on file a financial statement from each business concern to which they lend money. Such a statement is similar to that in the illustration on page 215. The information given in this statement is secured from the accounting records of the business concern and must be correct. Should a business concern establish a credit rating with a bank on the basis of a statement which did not contain facts, and then should fail to pay its obligations, the individual responsible for this incorrect statement would be subject to prosecution.

EXERCISE No. 154, MATURITY AND PRESENT VALUE

The only profit accruing to a bank through a loan of money is the interest collected at the time the loan is made or at maturity. The bank is interested in knowing (a) the maturity of the loan, and (b) the amount that will be collected at maturity, which includes the principal and the interest, if the latter was not deducted at the time the loan was made.

The following problems provide practice in determining the maturity, the present value, and the maturity value of notes.

FINANCIAL STATEMENT To THE FIFTH-THIRD NATIONAL BANK

(Corporation)

CORPORATE NAME The Keystone Manufacturing CompanyBUSINESS Manufacturers of automobilesMAIN OFFICE Detroit, Michigan LOCATION OF PLANT Detroit, Mich.BRANCHES Cincinnati, Ohio St. Louis, Mo.

FOR THE PURPOSE OF PROCURING CREDIT FROM TIME TO TIME WITH YOU, FOR OUR NEGOTIABLE PAPER OR OTHERWISE, WE FURNISH THE FOLLOWING AS A TRUE AND CORRECT STATEMENT OF OUR FINANCIAL CONDITION ON December 31 19 AND HEREBY AGREE TO NOTIFY YOU IMMEDIATELY IN WRITING OF ANY MATERIALLY UNFAVORABLE CHANGE IN OUR FINANCIAL CONDITION. IN THE ABSENCE OF SUCH NOTICE OR A NEW AND FULL WRITTEN STATEMENT, THIS IS TO BE CONSIDERED AS A CONTINUING STATEMENT, AND THAT OUR PRECIPUARY RESPONSIBILITY HAS NOT FALLEN BELOW THE CONDITION HEREIN SET FORTH AND IT IS HEREBY EXPRESSLY AGREED THAT UPON APPLICATION FOR ADDITIONAL CREDIT OR RENEWAL THIS STATEMENT AND INFORMATION SHALL HAVE THE SAME FORCE AND EFFECT AS IF DELIVERED AS AN ORIGINAL REPORT OF OUR FINANCIAL CONDITION AT THE TIME SUCH ADDITIONAL CREDIT OR RENEWAL IS REQUESTED.

ASSETS			LIABILITIES		
CASH ON HAND		105 00	BILLS PAYABLE (NOTES) FOR MERCHANDISE	5 000 00	
CASH IN BANK	7 645 00		BILLS PAYABLE FOR BORROWED MONEY TO OWN BANKS		
BILLS RECEIVABLE OF CUSTOMERS, DUE WITHIN 90 DAYS	6 805 18		BILLS PAYABLE FOR BORROWED MONEY FOR PAPER SOLD		
BILLS RECEIVABLE OF CUSTOMERS, DUE BEYOND 90 DAYS	1 444 82		BILLS PAYABLE TO DIRECTORS OR STOCKHOLDERS		
ACCOUNTS RECEIVABLE, ALL GOOD, OWING FROM CUSTOMERS	25 000 00		OPEN ACCOUNTS NOT DUE	15 000 00	
MERCHANDISE, FINISHED, AT ACTUAL PRESENT CASH VALUE	20 000 00		OPEN ACCOUNTS PAST DUE		
MERCHANDISE, UNFINISHED, AT ACTUAL PRESENT CASH VALUE	20 000 00		ACCOUNTS OWING DIRECTORS OR STOCKHOLDERS		
RAW MATERIAL	18 000 00		DEPOSITS AND OTHER TRUST FUNDS		
TRADE ACCEPTANCES OWNED	2 290 00		TRADE ACCEPTANCES PAYABLE	1 107 45	
			Accrued Payroll	1 592 55	
			Accrued Interest	8 000 00	
TOTAL QUICK ASSETS	99 490 00		TOTAL CURRENT LIABILITIES	30 700 00	
STOCKS, BONDS AND INVESTMENTS			MORTGAGES AND LIENS ON REAL ESTATE DUE		
MACHINERY AND FIXTURES	98 500 00		BONDS DUE	116 000 00	
REAL ESTATE	122 500 00		CHattel MORTGAGES		
ACCOUNTS AND BILLS RECEIVABLE, OWING FROM OFFICERS AND EMPLOYEES			DUE TO CONTROLLED OR ALLIED CONCERNS, For Merchandise		
BILLS RECEIVABLE, OWING FROM DIRECTORS OR STOCKHOLDERS			DUE TO CONTROLLED OR ALLIED CONCERNS, For Advances		
ACCOUNTS RECEIVABLE, OWING FROM DIRECTORS OR STOCKHOLDERS	1 000 00				
DUE FROM CONTROLLED OR ALLIED CONCERNS, FOR MERCHANDISE					
DUE FROM CONTROLLED OR ALLIED CONCERNS, FOR ADVANCES					
NOTES AND ACCOUNTS RECEIVABLE, 6 MONTHS OR MORE PAST DUE	1 235 65		CAPITAL STOCK OUTSTANDING PREFERRED		
Deferred Charges	764 35		CAPITAL STOCK OUTSTANDING COMMON	150 000 00	
Goodwill	50 000 00		RESERVES { SURPLUS	12 790 00	
			UNDIVIDED PROFITS	40 000 00	
			DEPRECIATION	24 000 00	
TOTAL	373 490 00		TOTAL	373 490 00	

I HEREBY SOLEMNLY DECLARE AND CERTIFY THAT THE ABOVE IS A TRUE STATEMENT OF OUR BUSINESS.

CORPORATE NAME Keystone Manufacturing Co.DATE SIGNED January 25 19 BY J. W. Baker

(Others Take Must Be Given) President

NOTE.—IF YOU HAVE ANY DIFFICULTY IN FILLING IN THE FOREGOING STATEMENTS AND QUESTIONARY, THE CREDIT DEPARTMENT OR ANY OTHER OFFICER OF THIS BANK IS PREPARED TO EXTEND YOU COURTEOUS AND INTELLIGENT SERVICE. IN FACT, WE SOUGHT YOUR CO-OPERATION AND ACQUAINTANCE WITH OUR CREDIT METHODS.

Financial Statement Submitted to a Bank as the Basis for
Financial Rating.

Present value is the amount the borrower receives. In each of these problems it is assumed that the note was received by the bank as evidence of a loan made on the date of the note, and that if the note is interest-bearing, the borrower received the face of the note; if it is non-interest-bearing, the borrower received the face of the note less the interest at the rate of 6% for the number of days stated in the note.

	FACE	DATE	TIME	MA- TURITY	INT. RATE	PRES- ENT VALUE	MA- TURITY VALUE
1.	\$ 500.00	May 11	60 days				
2.	300.00	Mar. 6	90 days		6%		
3.	1,000.00	April 1	60 days				
4.	600.00	July 2	90 days		6%		
5.	400.00	July 19	60 days				
6.	250.00	Nov. 16	90 days				
7.	100.00	Oct. 3	90 days				
8.	9,000.00	Sept. 1	90 days				
9.	700.00	June 2	60 days		8%		
10.	500.00	May 7	90 days		6%		

EXERCISE No. 155, TIME AND INTEREST TABLES

For the convenience of the discount clerks in banks, tables are available which will facilitate the calculations involved in ascertaining the interest on loans made by the bank or notes purchased by the bank. Below is a table which enables a person to find the exact number of days between two given dates.

FROM ANY DAY OF	TO THE SAME DAY OF THE NEXT											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
January.....	365	31	59	90	120	151	181	212	243	273	304	334
February.....	334	365	28	59	89	120	150	181	212	242	273	303
March.....	306	337	365	31	61	92	122	153	184	214	245	275
April.....	275	306	334	365	30	61	91	122	153	183	214	244
May.....	245	276	304	335	365	31	61	92	123	153	184	214
June.....	214	245	273	304	334	365	30	61	92	122	153	183
July.....	184	215	243	274	304	335	365	31	62	92	123	153
August.....	153	184	212	243	273	304	334	365	31	61	92	122
September....	122	153	181	212	242	273	303	334	365	30	61	91
October.....	92	123	151	182	212	243	273	304	335	365	31	61
November....	61	92	120	151	181	212	242	273	304	334	365	30
December....	31	62	90	121	151	182	212	243	274	304	335	365

To find the exact number of days from any day of any month to the corresponding day of any other month, within a year, find the number in the column for the latter month, which is directly opposite the line of the first month. From March 3 to June 3 is 92 days; from October 4 to December 4 is 61 days; from February 3 to November 16 is $273 + 13$ or 286 days. In leap years add one day if February 29 is between the two dates given.

The table on page 218 gives the interest on \$100 for the time stated at the left and at the rate stated at the top. The interest calculations are based on a year of 360 days. Thus, the interest on \$100 for 1 day at 4% is .0111, as stated on the first line, fifth column from the left in the table; the interest on \$100 for 29 days at $6\frac{1}{2}\%$ is .5236, as stated in the second column from the right on a line with 29 days at the left.

When interest is ascertained through the use of time and interest tables, it is necessary first to ascertain the time from the time table and then to find the interest on \$100 for this time from the interest table. The given principal multiplied by the interest on \$100 for the given time will produce the desired interest provided two places are pointed off in the product because of the \$100 basis. The illustration below shows the method of using the time and interest tables when the interest on \$725.40 from June 9 to August 10 at 6% is to be ascertained.

June 9 to August 10 is 62 days. By referring to the interest table, you will observe that the interest on \$100 at 6% for 60 days is \$1.00 and for 2 days, \$.0333. $\$1.00 + .0333 = \1.0333 , interest at 6% for 62 days on \$100. The interest on \$725.40 = $7.2540 \times \$1.0333 = \$7.4955582 = \$7.50$.

The following problems provide practice in applying the time and interest tables:

1. \$ 840.25 from May 11 to June 19 at 7%
2. 17.50 from May 5 to May 27 at 5%
3. 4,500.00 from July 6 to October 11 at $4\frac{1}{2}\%$
4. 6,000.00 from September 6 to December 24 at 3%
5. 375.12 from March 17 to March 29 at 7%
6. 335.85 from May 1 to October 1 at $4\frac{1}{2}\%$
7. 250.00 from May 4 to October 7 at 6%
8. 725.75 from July 1 to October 1 at 6%
9. 960.50 from May 19 to September 11 at $6\frac{1}{2}\%$
10. 425.24 from June 16 to October 12 at $4\frac{1}{2}\%$

SIMPLE INTEREST TABLE
 (\$100.00 on a 360-Day Year Basis)

Time	2½%	3%	3½%	4%	4½%	5%	5½%	6%	6½%	7%
1 da.	.0069	.0083	.0097	.0111	.0125	.0139	.0153	.0167	.0181	.0194
2 da.	.0139	.0167	.0194	.0222	.0250	.0278	.0306	.0333	.0361	.0389
3 da.	.0208	.0250	.0292	.0333	.0375	.0417	.0458	.0500	.0542	.0583
4 da.	.0278	.0333	.0389	.0444	.0500	.0556	.0611	.0667	.0722	.0778
5 da.	.0347	.0417	.0486	.0556	.0625	.0694	.0764	.0833	.0903	.0972
6 da.	.0417	.0500	.0583	.0667	.0750	.0833	.0917	.1000	.1083	.1167
7 da.	.0486	.0583	.0681	.0778	.0875	.0972	.1069	.1167	.1264	.1361
8 da.	.0556	.0667	.0778	.0889	.1000	.1111	.1222	.1333	.1444	.1556
9 da.	.0625	.0750	.0875	.1000	.1125	.1250	.1375	.1500	.1625	.1750
10 da.	.0694	.0833	.0972	.1111	.1250	.1389	.1528	.1667	.1806	.1944
11 da.	.0764	.0917	.1069	.1222	.1375	.1528	.1681	.1833	.1986	.2139
12 da.	.0833	.1000	.1167	.1333	.1500	.1667	.1833	.2000	.2167	.2333
13 da.	.0903	.1083	.1264	.1444	.1625	.1806	.1986	.2167	.2347	.2528
14 da.	.0972	.1167	.1361	.1556	.1750	.1944	.2139	.2333	.2528	.2722
15 da.	.1042	.1250	.1458	.1667	.1875	.2083	.2292	.2500	.2708	.2917
16 da.	.1111	.1333	.1556	.1778	.2000	.2222	.2444	.2667	.2889	.3111
17 da.	.1181	.1417	.1653	.1889	.2125	.2361	.2597	.2833	.3069	.3306
18 da.	.1250	.1500	.1750	.2000	.2250	.2500	.2750	.3000	.3250	.3500
19 da.	.1319	.1583	.1847	.2111	.2375	.2639	.2903	.3167	.3431	.3694
20 da.	.1389	.1667	.1944	.2222	.2500	.2778	.3056	.3333	.3611	.3889
21 da.	.1458	.1750	.2042	.2333	.2625	.2917	.3208	.3500	.3792	.4083
22 da.	.1528	.1833	.2139	.2444	.2750	.3056	.3361	.3667	.3972	.4278
23 da.	.1597	.1917	.2236	.2556	.2875	.3194	.3514	.3833	.4153	.4472
24 da.	.1667	.2000	.2333	.2667	.3000	.3333	.3667	.4000	.4333	.4667
25 da.	.1736	.2083	.2431	.2778	.3125	.3472	.3819	.4167	.4514	.4861
26 da.	.1806	.2167	.2528	.2889	.3250	.3611	.3972	.4333	.4694	.5056
27 da.	.1875	.2250	.2625	.3000	.3375	.3750	.4125	.4500	.4875	.5250
28 da.	.1944	.2333	.2722	.3111	.3500	.3889	.4278	.4667	.5056	.5444
29 da.	.2014	.2417	.2819	.3222	.3625	.4028	.4431	.4833	.5236	.5639
1 mo.	.2083	.2500	.2917	.3333	.3750	.4167	.4583	.5000	.5417	.5833
2 mo.	.4167	.5000	.5833	.6667	.7500	.8333	.9167	1.0000	1.0833	1.1667
3 mo.	.6230	.7500	.8750	1.0000	1.1250	1.2500	1.3750	1.5000	1.6250	1.7500
4 mo.	.8333	1.0000	1.1667	1.3333	1.5000	1.6667	1.8333	2.0000	2.1667	2.3333
5 mo.	1.0417	1.2500	1.4583	1.6667	1.8750	2.0833	2.2917	2.5000	2.7083	2.9160
6 mo.	1.2500	1.5000	1.7500	2.0000	2.2500	2.5000	2.7500	3.0000	3.2500	3.5070

EXERCISE No. 156, INTEREST ON BANK LOANS

The following problems provide additional practice in ascertaining the amount of money a borrower will receive on the paper given to a bank as evidence of a loan:

1. James Brown applied to the First National Bank for a loan of \$400. He was told to present his 60-day note, with in-

terest at 6% from date, for this amount. He presented the note on May 19 and received \$400 in cash. When was the note due? How much was Brown required to pay on the due date?

✓ 2. Robert Downing presented to the City National Bank his note for \$800, dated June 17 and due in 90 days. He received in cash from the bank the face of the note less the interest at 8% for 90 days. (a) How much cash did he receive from the bank? (b) What was the maturity date of the note? (c) What was the maturity value of the note?

3. W. L. Douglas applied to the Citizens National Bank for a loan of \$1,000 and was told to present his note, with interest at 6%, payable in 90 days. He presented the note on November 4 and received \$1,000 in cash. (a) When did this note mature? (b) What amount did Douglas owe the bank on that date?

4. On March 5 C. L. Lloyd borrowed from the Merchants National Bank \$2,500 on his 90-day note. The bank gave him cash for the face of the note less interest at 6% for 90 days. (a) How much cash did he receive? (b) When did the note mature? (c) How much cash did he pay the bank at maturity?

5. On May 27 James King borrowed \$250 from the Union Trust Company on his 60-day interest-bearing note. He received \$250 in cash from the bank. (a) When did this loan mature? (b) What amount of cash did he pay the bank at maturity, provided the rate of interest on the note was 9%?

✓ 6. On May 17 the Union Manufacturing Company borrowed \$10,000 from the Second National Bank at 5% for 90 days. It issued a note for \$10,000 in favor of the bank and received cash for the difference between the face of the note and the interest agreed upon. (a) How much cash did the company receive from the bank? (b) When did the loan mature?

7. D. H. Mosier borrowed \$100 from the Citizens Bank and Trust Company. He gave his 30-day note for this amount, payable to the bank, and received in cash the face of the note less the interest for 30 days at 8%. How much did he receive?

✓ 8. Albert Donaldson arranged with the Third National Bank for a loan of \$5,000 on his 90-day note, with interest at 6%. He presented his note to the bank on May 16 and received \$5,000 in cash. At the maturity of the note, he paid the interest and half

of the note and renewed the other half by a non-interest-bearing note due in 90 days, on which he paid the interest in advance.

(a) When was the first note due? (b) How much interest did Mr. Donaldson pay the bank on the first note? (c) What was the amount of the new note given to renew a part of the first note? (d) How much interest did Mr. Donaldson pay on this new note? (e) How much cash did he pay the bank at the maturity of the second note?

EXERCISE No. 157, INTEREST ON BANK LOANS

When a note is given as evidence of a loan, the borrower, or maker of the note, receives cash or credit for the face value, provided the note bears interest. If it does not bear interest, he receives cash or credit for the face of the note less the interest for the time the note is to run. This condition applies only when the note is given in evidence of a loan and not when the note of another is discounted at the bank.

On March 13 James Brown borrows \$375.50 from the City National Bank and gives in evidence of this loan a 90-day note with interest at 8%. The calculations below show one method of ascertaining (a) the due date and (b) the amount Mr. Brown will pay the bank at the maturity of the note.

31 - 13 = 18	remaining days in March	Face of note, \$375.50
April	30 days	3.755 Int. 6% for 60 days
May	31 days	1.8775 Int. 6% for 30 days
June	11 days	Due date
<u>90</u>		
		3)5.6325 Int. 6% for 90 days
		1.8775 Int. 2% for 90 days
		<u>7.51</u> Int. 8% for 90 days
		375.50
		<u>383.01</u> Maturity Value

The borrower receives the face of the note, because the note is interest-bearing. At maturity he pays the bank the face of the note and interest at the agreed rate. Had he given a non-interest-bearing note as evidence of the indebtedness, he would have received \$367.99 and paid \$375.50 on the due date.

The following problems provide practice in discounting notes. The note in each problem was given as evidence of a loan made on the date mentioned. The borrower received the face of the note if it was interest-bearing; he received the face of the note less interest at 8% for the specified time, if the note was non-interest-bearing.

For each problem you are given the face of the note, the date, the time, and the rate of interest if the note is interest-bearing.

For each you are to find (a) the due date, (b) the interest, (c) the cash received by the borrower, and (d) the amount due at maturity.

	FACE	DATE	TIME	INT. RATE
1.	\$ 273.50	Mar. 9	90 days	8%
2.	542.50	May 1	60 days	7%
3.	85.50	July 1	120 days	9%
4.	2,500.00	Aug. 1	75 days	5%
5.	752.65	Mar. 1	90 days	
6.	96.95	July 12	66 days	8%
7.	726.25	Mar. 5	60 days	
8.	244.55	Jan. 1	30 days	8%
9.	1,500.00	Mar. 15	120 days	
10.	400.00	May 7	120 days	9%
11.	204.50	June 14	60 days	7%
12.	1,200.00	May 1	120 days	7%

EXERCISE No. 158, INTEREST ON BANK LOANS

The following problems provide additional practice in ascertaining the information needed by a bank (a) at the time a loan is made and (b) at maturity. Use 7% in finding the present value of the non-interest-bearing notes.

	FACE	DATE	TIME	MA- TURITY	INT. RATE	PRES- ENT VALUE	MA- TURITY VALUE
1.	\$1,245.55	Sept. 21	30 days		6%		
2.	225.45	Nov. 15	90 days				
3.	2,110.50	May 1	60 days		5%		
4.	3,500.15	Jan. 12	90 days		8%		
5.	550.65	Mar. 15	30 days				
6.	1,035.16	June 5	60 days		6%		
7.	672.35	Aug. 16	90 days		6%		
8.	2,156.45	Sept. 12	30 days				
9.	1,123.65	Feb. 12	90 days		7%		
10.	335.15	Dec. 13	60 days				
11.	125.16	April 8	30 days		6%		
12.	3,412.76	May 11	90 days				
13.	1,444.25	Mar. 3	60 days		6%		
14.	655.75	Dec. 15	30 days				
15.	225.50	June 10	30 days				
16.	1,006.75	July 6	60 days		6%		

CHAPTER 46

DISCOUNTING NOTES

Merchants and manufacturers frequently accept notes from their customers in payment for merchandise or in settlement of accounts. If a merchant or a manufacturer who has received notes from customers wishes to borrow from his bank, he may give to the bank his own note or may transfer to it one or more of the notes of his customers. When one transfers the note of another to the bank, he is said to *discount* the note. He receives in cash or as a credit to his account the present value of the note, that is, the difference between the value of the note at the time of maturity and the interest on the maturity value from the date of discount to the date of maturity. The sum received when a note is discounted is commonly referred to as the *proceeds*.

When one discounts the non-interest-bearing note of another, the process of determining the present value of the note is much the same as the process of determining the present value of the borrower's own note. In calculating the interest, the bank considers only the time from the date of discount to the date of maturity for it will have to wait only that period to collect the loan.

Duncan Brothers, wholesale hardware merchants, received from the Howard Construction Company the note illustrated below. On July 1 they desire to borrow from the City National Bank the present value of the note less 6%. The calculations necessary to ascertain the amount of cash Duncan Brothers will receive are given at the top of page 223.

	\$789⁶⁵ BERWICK, PA. <u>June 1 19</u> <u>Four months</u> after date we promise to pay to the order of <u>Duncan Brothers</u> <u>Seven Hundred Eighty nine and 65/100</u> Dollars at <u>First National Bank</u> Value received No. <u>131</u> Due <u>Oct. 1</u> <u>Howard Construction Co</u> per E. A. Howard, Pres.
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Amt. due at maturity, Oct. 1, \$789.65

Time from July 1 to Oct. 1, 92 da.

6% Int. on \$789.65 for 92 days, 12.11

Present value of note, July 1, \$777.54

The note does not bear interest; hence, only the face value can be collected at maturity. The number of days between July 1 and October 1 is ascertained by counting the actual number of days as you did in pre-

vious exercises. The amount due at maturity, less 6% interest from the date of discount to the date of maturity, is the present value of the note, which is the amount Duncan Brothers will receive in cash or have credited to their account.

The following problems provide practice in ascertaining the present value of non-interest-bearing notes which are discounted at a date subsequent to the date of the note. The present value of the note in each case is the face less the interest for the number of days between the discount date and the maturity date.

1. You are to ascertain the amount of credit received by Adler Bros. if this note was discounted on (a) June 16 at 8% discount, (b) July 1 at 7% discount, or (c) July 15 at 6% discount. The maturity date of this note is 90 days after May 11. The actual days are to be counted.

\$361.00	DOVER, OHIO.	May 11 19__
	Ninety days after date I promise to pay to the order of Adler Bros.	
	Three Hundred Sixty-one 00/100 Dollars	
	at Fifth Third National Bank	
	Value received	
No 12	Due	James G. Buckhart

2. You are to ascertain the amount of cash received by Mr. Thomas if the note at the top of page 224 was discounted at the bank on (a) December 1 at 6% discount, (b) December 24 at 7% discount, or (c) January 6 at 8% discount.

NOTE: A note due 4 months after date is due on the same day of the fourth month after the one in which it was dated. The exact days are used in calculating the discount regardless of the length of the discount period.

	\$250.00	EVANSVILLE, IND.,	Oct 4 19
	Four months after date I promise to pay to		
	the order of E. B. Thomas		
	Two Hundred Fifty ⁰⁰ / ₁₀₀ Dollars		
	at Citizens Bank & Trust Co		
Value received			
No 111	Due	Paul A. Kilsman	

3. L. M. Guilfoil gave A. L. Flanagan a 60-day non-interest-bearing note, dated March 1, for \$122.50. Find the amount of cash received by Mr. Flanagan if he discounted this note at the bank on (a) March 5 at 9%, (b) April 1 at 7%, or (c) April 5 at 8%.

4. Harrison A. Moore gave E. R. Duncan a 90-day non-interest-bearing note, dated March 16, for \$72.15. If Mr. Duncan discounted this note at the bank on April 1 at 6%, how much would he receive? How much would he receive if he discounted it on May 1 at 8%? on May 31 at 9%?

5. Johnson Brothers received from The Moores-Coney Co., a 3-month non-interest-bearing note for \$101.10, dated June 5. Find the amount of cash received from the bank if the note was discounted on (a) July 3 at 7%, (b) July 25 at 8%, or (c) July 30 at 9%.

6. Donald L. Baechle gave A. F. Harman a note for \$75 without interest, dated March 1, and due in 6 months. Ascertain the cash received if this note was discounted on (a) March 10 at 6%, (b) April 1 at 8%, or (c) May 1 at 7%.

EXERCISE No. 159, DISCOUNTING INTEREST-BEARING NOTES

When an interest-bearing note is discounted, it is necessary to ascertain the maturity value by adding to the face of the note, the interest at the designated rate for the number of days between the date and the maturity of the note. It is necessary to know the maturity value, because the present value is always calculated on the maturity value.

Atlas Bros. received from G. A. Craft the note illustrated at the top of page 225 and on July 2 discounted it at 8% at the Merchants National Bank. The calculations necessary to ascertain (a) the maturity value and (b) the present value are shown below the note.

\$437.58 Dallas, Texas, June 16 19
 Ninety days after date I promise to pay to
the order of Atlas Bros.
Four Hundred Thirty seven and 5/100 Dollars
 at _____
Value received with interest at 6%.
No. 151 Due Sept. 14 G. A. Craft

Face of the note, \$437.58

Interest at 6% for 90 days = \$6.56

Maturity value = \$437.58 + \$6.56 =
\$444.14

Date of note, June 16

Due date = (14 + 31 + 31 + 14) Sep-
tember 14

July 2 to September 14 = (29 + 31 + 14)

74 days

Interest on \$444.14 for 74 days at

6% = $(\$444.14 \times 12\frac{1}{2}) \div 54$ \$5.477728% = $1\frac{1}{3}$ times 6%\$5.47772 $\times 1\frac{1}{3}$ = \$7.30, the discount\$444.14 - \$7.30 = \$436.84 = cash re-
ceived by Atlas Bros.

The first information necessary is the maturity value of the note, which is the face of the note plus 6% interest for 90 days. The number of days the bank will have to wait before maturity is the difference in time between July 2 and September 14, or 90 days minus the time between the date of the note and the date on which the note is discounted. The present value of the note is the difference between the maturity value of the note and the interest on the maturity value at 8% for the number of days Atlas Bros. will use the money before the bank makes collection.

1. You are to ascertain the amount of cash Mr. Hardin would receive from the bank if this note were discounted on (a) October 15 at 8%, (b) November 1 at 7%, or (c) December 11 at 9%.

\$112.21 ASHLAND, PA. Oct. 1 19
 Ninety days after date I promise to pay to
the order of R. R. Hardin
One Hundred Twelve and 2/100 Dollars
 at Merchants National Bank
Value received with interest at 6%.
No. 57 Due E. H. Church

2. You are to ascertain the amount of cash received from the bank by Black Bros. if this note were discounted at the bank on (a) February 5 at 7%, (b) March 1 at 8%, or (c) April 1 at 6%.

	\$300 ⁰⁰	ATOKISON, KANS.	Jan. 30 19
	Four months after date I promise to pay to		
	the order of Black Bros.		
	Three Hundred		Dollars
	at their office		
Value received with interest at 6%			
No 30	Due	P. H. Reid	

NOTE: The due date is 4 months from January 30, or May 30, but since this is a legal holiday, the note cannot be collected until May 31. The number of days between January 30 and May 31, if 28 days are counted in February, is 121 days. The maturity value of this note will be the face plus interest at 6% for 121 days. Some banks would add to the face of this note the interest for four months, or 120 days, disregarding the actual number of days. The tendency in modern banking, however, is to use the actual number of days in interest calculations. Unless otherwise instructed, you will follow this plan when the time of an interest-bearing-note is a designated number of months.

3. P. H. Slacke gave The Fair Store a 60-day note for \$37.50, dated April 1 and bearing 6% interest. Find the amount received from the bank if this note was discounted by The Fair Store on (a) April 20 at 8%, (b) May 1 at 7%, or (c) May 15 at 6%.

4. U. R. Moore gave Lessen Brothers a 3-month note for \$126.30, dated September 25 and bearing 6% interest. What amount would be received by Lessen Brothers should they discount this note at the bank on (a) October 1 at 7%, (b) November 1 at 8%, or (c) November 15 at 8%?

CHAPTER 47

DRAFTS

A *draft* is a written order by which a creditor directs his debtor to pay the amount of the indebtedness to the creditor or to a third party. Drafts are generally used in business as a means of collecting from debtors when it is not convenient to collect in person. If the creditor wishes the debtor to have more time in which to pay the account, he states the number of days in the draft. If he wishes the account paid at once, he makes the draft payable at sight. A draft drawn a designated number of days after date must be accepted, before it becomes effective.

The one drawing the draft is known as the *drawer*, the one on whom it is drawn is the *drawee*, and the one in whose favor it is drawn is the *payee*. Any draft may be interpreted as meaning that the drawee owes the drawer, and the drawer has asked the drawee to pay the amount to the payee.

\$ 225.50	BOSTON,	April 1, 19__
At thirty days sight	Pay to the	
Order of Ourselves		
Two Hundred twenty-five and	50/100	Dollars
Value received and charge to account of		
To Robt. A. Davis	Donaldson Bros.	
No. 14 Winchester, Ind.	By E. E. Eaton	

Robert A. Davis, of Winchester, Indiana, owes Donaldson Bros., of Boston, Massachusetts, \$225.50. Donaldson Bros. draw a draft payable to themselves and send it to the Winchester National Bank for collection. When the bank receives the draft, it presents the draft to Mr. Davis who accepts it. The indebtedness is now in the form of a written contract, and Donaldson Bros. can borrow from the bank by using the accepted draft as security. If Donaldson Bros. do not wish to discount the draft, they may instruct the bank to retain the draft until maturity, to collect it, and to remit to them the amount collected less the charges for collection.

EXERCISE No. 160, DISCOUNTING DRAFTS

When a bank discounts an accepted draft, it pays the maturity value less the agreed discount from the day on which the draft is discounted until maturity. A draft is usually made payable a designated number of days after sight; hence, it matures the stated number of days after the date of acceptance. A draft is sometimes made payable a designated number of days after date, in which case it matures the designated number of days after the date of the draft and not after the date of acceptance. Sight drafts, except when used for foreign shipments, are seldom bought by banks, because they are payable upon presentation.

The following problems provide practice in ascertaining (a) the discount on an accepted draft and (b) the cash value on the day on which the draft is discounted.

1. You are to ascertain the amount of cash Arnold & Day would receive if this draft were discounted at the bank on (a) June 12 at 7%, (b) June 25 at 8%, or (c) July 5 at 8%.

just the same as now interest bearing not except he accepted

\$126 ²⁰	June 12	COLUMBUS OHIO	June 12 19
At thirty days sight		Pay to the	
Order of <i>King & Co</i>			
One Hundred Twenty-six and ²⁰ / ₁₀₀ Dollars			
Value received, and charge the same to account of			
To <i>McLaughlin & King Co</i>			
No. 13	Canton Ohio	Arnold & Day per S. H. Arnold	

2. You are to ascertain the amount Johnson Realty Co. would receive if this draft were discounted at the bank on (a) May 6 at $4\frac{1}{2}\%$, (b) May 20 at 5%, or (c) June 1 at 6%.

figure date from date of acceptance

\$79 ²⁰	Apr 23	ALBANY, N. Y.	Apr 20 19
At thirty days sight		Pay to the	
Order of <i>Union Trust & Savings Co</i>			
Seventy-nine and ²⁰ / ₁₀₀ Dollars			
Value received, and charge the same to account of			
To <i>A. B. Worthing</i>			
No. 7	Cincinnati O.	Johnson Realty Co	

3. On May 1 Day & Day, of Cleveland, Ohio, drew a 30-day sight draft on the Shroder Shoe Co., of Denver, Colorado, for \$88.11. The draft was received and accepted on May 5 and then was returned to Day & Day. Find the cash received by Day & Day if they discounted the draft at their bank on (a) May 8 at 8%, (b) May 10 at $7\frac{1}{2}\%$, or (c) May 15 at 9%.

4. W. W. Werner, of Spokane, Washington, accepted, on October 4, a 60-day sight draft for \$111.27, drawn by the Regal Shoe Company, of Cincinnati, Ohio, and dated October 1. How much cash was received from the bank if the Regal Shoe Company discounted the draft on (a) October 22 at 6%, (b) October 30 at 7%, or (c) November 15 at 8%?

TRADE ACCEPTANCE

A *trade acceptance* is a time draft drawn in settlement of a sale of merchandise. The difference between a trade acceptance and an ordinary time draft is that the former is drawn at the time a debt is contracted, whereas the latter is drawn for the purpose of collecting a past-due account.

The merchant who extends credit on open account can collect only in accordance with the terms of the sale. The merchant who sells merchandise and secures a trade acceptance cannot collect until the trade acceptance is due, but he can sell the trade acceptance to a bank and secure the cash less the discount.

TRADE ACCEPTANCE	
No. <u>712</u>	EASTON, PA. <u>July 20 1919</u>
To <u>Seaton Bros.</u>	<u>Clanton, Mo.</u>
On <u>August 25</u> (DATE OF MATURITY)	Pay to the order of <u>Ourselves</u>
<u>Two Hundred Seventy-five and 5/100</u> Dollars, (\$ <u>275.50</u>)	
The obligation of the acceptor hereof arises out of the purchase of goods from the drawer. The drawee may accept this bill payable at any bank, banker or trust company in the United States which he may designate.	
Accepted at <u>Clanton, Mo.</u> on <u>July 25</u> 191 <u>9</u>	Payable at <u>First National</u> Bank <u>Seaton Bros.</u> (SIGNATURE OF ACCEPTOR) By <u>R. A. Watson & Co.</u> <u>P. M. Davis</u>
By <u>E. A. Seaton</u>	

On July 20 R. A. Watson & Co. sold Seaton Bros. merchandise for \$275.87. Seaton Bros. agreed to honor a trade acceptance. The invoice for the merchandise was mailed to Seaton Bros., and the trade acceptance was sent either to them or to the First National Bank for acceptance. Usually a trade acceptance is sent to the debtor. He then accepts it and either returns it

to the creditor or sends it to the bank. If the trade acceptance drawn by R. A. Watson & Co. was sold to the bank, the deduction for discount was the interest on the amount for the number of days from the date on which the bank purchased it to August 25.

EXERCISE No. 161, DISCOUNTING TRADE ACCEPTANCES

An accepted trade acceptance is a written negotiable contract the same as an accepted draft or a signed note. The following trade acceptances and instructions pertaining to each provide practice in ascertaining (a) the discount on a trade acceptance and (b) the cash value on the day on which it is discounted.

✓ 1. You are to ascertain the amount of cash the Towns Grocery Co. would receive from the bank if this trade acceptance were discounted on (a) October 5 at 6%, (b) October 20 at 7%, or (c) November 5 at 8%.

TRADE ACCEPTANCE	
No. <u>18</u>	CHANUTE, KANSAS, <u>October 1</u> , 19 <u>1915</u>
To <u>Kloak Bros. Co.</u>	<u>Cincinnati, Ohio</u>
On <u>November 15</u>	Pay to the order of <u>Ourselves</u>
(DATE OF MATURITY)	
<u>One Hundred One</u> ⁵⁰ / ₁₀₀ Dollars, (\$ <u>101.50</u>)	
The obligation of the acceptor hereof arises out of the purchase of goods from the drawer. The drawee may accept this bill payable at any bank, banker or trust company in the United States which he may designate.	
Accepted at <u>Cincinnati</u> on <u>Oct. 3</u> , 19 <u>1915</u>	By <u>Towns Grocery Co.</u> By <u>C. J. Gidden</u>
Payable at <u>Fifth Third National</u> Bank	
By <u>Kloak Bros. Co.</u> (SIGNATURE OF ACCEPTOR) By <u>J. M. Stickley</u>	

NOTE: When the due date is stated specifically in a trade acceptance, the date on which the paper was drawn and the date of acceptance do not affect the interest calculations.

2. R. Griffith, of Portsmouth, Virginia, drew a trade acceptance, dated November 18, on The F. H. Lawson Company, of Minneapolis, Minnesota, for \$138.90, which was for merchandise purchased by the latter. The F. H. Lawson Company accepted it on November 22. The acceptance matured on January 15 and was payable at The Union National Bank, of Minneapolis. Find the amount received by Mr. Griffith if he discounted the acceptance at the bank on (a) December 5 at 7%, (b) December 24 at 7%, or (c) January 2 at 6%.

3. The Ferris Construction Company, of Seattle, Washington, drew a trade acceptance for \$2,750, dated July 1, on The J. R.

Stevens Company, of Frankfort, Kentucky. The J. R. Stevens Company accepted the draft on July 3. The acceptance was payable October 1 at the Merchants National Bank, of Frankfort. What were the proceeds if the acceptance was discounted on (a) July 15 at 6%, (b) August 1 at 6%, or (c) September 1 at 6%?

4. You are to ascertain the amount of cash the McKinzie Manufacturing Company would receive for this trade acceptance if it was sold to the bank on (a) March 9 at 5%, (b) April 1 at 6%, or (c) May 1 at 8%.

TRADE ACCEPTANCE			
No. <u>2</u>	Houston, Texas, <u>Mar. 2</u> 19 <u>19</u>		
To <u>The Silvertown Supply Co.</u>	<u>Norwood, Ohio</u>		
On <u>May 1</u> (DATE OF MATURITY)	Pay to the order of <u>Ourselves</u>		
<u>Two Hundred Seventy-two</u> ^{<u>45</u>} / _{<u>100</u>} Dollars, (\$ <u>272</u> ^{<u>45</u>} / _{<u>100</u>})			
The obligation of the acceptor hereof arises out of the purchase of goods from the drawer. The drawee may accept this bill payable at any bank, banker or trust company in the United States which he may designate.			
Accepted at <u>Norwood</u> on <u>Mar. 5</u> 19 <u>19</u>	<table> <tr> <td>By <u>McKinzie Mfg Co</u></td> </tr> <tr> <td>By <u>C. C. Ernst</u></td> </tr> </table>	By <u>McKinzie Mfg Co</u>	By <u>C. C. Ernst</u>
By <u>McKinzie Mfg Co</u>			
By <u>C. C. Ernst</u>			
Payable at <u>Norwood National</u> Bank			
<u>The Silvertown Supply Co.</u> (SIGNATURE OF ACCEPTOR)			
By <u>L. W. Stallman</u>			

CHAPTER 48

OTHER COMMERCIAL PAPERS

Notes, accepted drafts, and trade acceptances are usually referred to as *commercial papers*. The Garner Wholesale Grocery Company discounted the commercial papers given in the following list at the City National Bank on August 20 at 8% discount. You are to show: (a) all the calculations necessary to obtain the desired information regarding each note, which is to be inserted in the blank columns, and (b) the total amount of credit the Garner Wholesale Grocery Company received for these discounted papers.

No.	DATE OF PAPER	TIME	RATE	DATE DUE	FACE OF PAPER	INTER- EST	DIS- COUNT	PROCEEDS
1.	June 5	3 mos.	6%		\$ 2,000.00			
2.	June 1	4 mos.	6%		2,500.00			
3.	Aug. 1	90 days	no		2,000.00			
4.	June 5	90 days	6%		425.55			
5.	July 12	60 days	no		827.50			
6.	May 16	5 mos.	6%		1,841.44			
7.	Aug. 1	60 days	no		4,000.00			
8.	Mar. 5	6 mos.	no		627.84			
9.	July 10	90 days	6%		721.84			
10.	June 5	90 days	6%		316.65			
11.	July 12	90 days	6%		2,215.40			
12.	Aug. 1	60 days	no		10,000.00			
13.	July 6	60 days	8%		1,421.60			
14.	July 12	90 days	6%		2,715.27			
15.	July 16	4 mos.	6%		897.46			

EXERCISE No. 162, AUDITING INTEREST CALCULATIONS

The loans register is a book used by a bank in recording detailed information about the commercial papers held by it as evidence of loans. Facts about the loans made by the City National Bank on June 5, as shown by the loans register, are given in the eight columns on the following page.

On an interest-bearing note, dated June 5, such as Note No. 1, the borrower receives the face of the note. On an interest-bearing note, dated before June 5, the borrower receives the face value of the note plus the interest, minus the discount to the date of maturity at 6%. On a non-interest-bearing note, such as Note No. 4, the borrower receives the face of the note less the discount to the date of maturity at 6%.

Errors may have been made by the one recording the information in the loans register. You are (a) to verify the facts recorded and to report all errors, and (b) to find the sum of the correct proceeds of all the notes.

No.	DATE OF PAPER	TIME	RATE	DATE DUE	FACE OF PAPER	INTER- EST	DIS- COUNT	PROCEEDS
1.	6/5	3 mos.	6%	9/5	\$ 200			\$ 200.00
2.	5/26	60 days	6%	7/25	500	\$ 5	\$ 4.11	500.79
3.	5/6	90 days	6%	8/4	1,000	14	10.15	1,002.75
4.	6/5	60 days	no	8/4	400		4.00	395.00
5.	4/1	90 days	6%	6/30	600	10	2.64	606.46
6.	5/1	4 mos.	6%	9/1	350	8	5.24	351.76
7.	6/5	90 days	6%	9/3	5,500			5,500.00
8.	6/5	90 days	no	9/3	7,500		112.50	7,387.50
9.	4/15	120 days	6%	8/13	2,000	40	24.46	2,016.54
10.	6/4	60 days	no	8/3	960		9.54	950.56
11.	5/15	90 days	6%	8/13	5,000	75	58.46	5,016.64
12.	5/1	60 days	6%	6/30	4,000	40	17.83	4,022.17
13.	6/5	90 days	6%	8/3	3,000			3,000.00
14.	5/31	60 days	6%	7/30	2,500	25	24.15	2,501.85
15.	6/5	60 days	no	8/4	6,000		60.00	5,930.00

EXERCISE No. 163, CERTIFICATES OF DEPOSIT

Banks sometimes pay interest for the use of money belonging to others. The usual conditions under which interest is paid are: (a) on certificates of deposit, (b) on daily balances of large checking accounts, (c) on savings accounts, (d) through rediscounting notes, and (e) on money deposited with the banks by their correspondent banks.

When money is deposited with a bank for a definite time and is not subject to check, the bank acknowledges receipt of the money by issuing a form known as a *certificate of deposit*, which states the time, the amount, and the rate of interest.

A certificate of deposit is a written promise of the bank to pay money to the holder because the holder deposited money with the bank. Some banks require money to be left with them 4 months, others 6 months, and others a year, before interest will be paid. The rate of interest is determined by the demand for money, but it is usually 3% or 4%. A certificate of deposit affords an excellent means of securing an income from money which the owner does not wish to invest permanently.

CERTIFICATE OF DEPOSIT	
	FARMERS STATE BANK 76-1112 10
THIS CERTIFIES <u>ERICSON, NEBR.</u> <u>Mar. 1</u> 19 <u>No. 9560</u>	
THAT <u>Wm. Reilly</u> HAS DEPOSITED IN THIS BANK	
<u>One Thousand and no/100</u> \$ <u>1000.00</u>	
PAYABLE TO THE ORDER OF <u>J. R. Baker</u>	
ON THE RETURN OF THIS CERTIFICATE PROPERLY ENDORSED. <u>6</u> MONTHS AFTER DATE	
WITH INTEREST AT THE RATE OF <u>4</u> PER CENT PER ANNUM	
NO INTEREST AFTER MATURITY.	
<u>Samuel G. Gley</u> CASHIER	
NOT SUBJECT TO CHECK	

The following problems provide practice in ascertaining the interest on certificates of deposit. These represent money which has been left with the bank for a definite time and on which the bank is to pay the stated interest. You may assume that the bank allows interest for only 30 days after the maturity of any certificate not paid at maturity. You are to show all of the calculations necessary to ascertain the amount paid by the bank for each certificate.

No.	DATE	AMOUNT	TIME	RATE	DATE PAID	AMOUNT PAID
1.	May 6	\$ 5,000.00	6 mos.	3½%	Nov. 6	
2.	July 7	1,000.00	4 mos.	4%	Nov. 7	
3.	Feb. 6	12,500.00	1 year	4%	Feb. 6	
4.	May 12	250.00	3 mos.	4½%	Aug. 12	
5.	Oct. 11	9,500.00	6 mos.	2½%	May 31	
6.	June 16	11,856.00	1 year	2½%	June 16	
7.	Jan. 2	9,000.00	4 mos.	3½%	June 10	
8.	July 2	9,000.00	6 mos.	4%	Feb. 6	
9.	Oct. 27	25,000.00	90 days	3%	Mar. 9	
10.	Sept. 6	6,250.00	4 mos.	3%	Feb. 5	
11.	Dec. 4	1,560.00	5 mos.	4%	May 4	

No.	DATE	AMOUNT	TIME	RATE	DATE PAID	AMOUNT PAID
12.	Mar. 5	\$ 2,500.00	6 mos.	4%	Oct. 25	
13.	April 12	18,565.00	1 year	2½%	April 12	
14.	June 6	7,500.00	90 days	4½%	Oct. 16	
15.	Oct. 9	450.00	4 mos.	4%	Mar. 30	
16.	Nov. 6	28,500.00	3 mos.	3½%	Feb. 6	
17.	Feb. 6	6,650.00	6 mos.	3½%	Sept. 10	
18.	Oct. 11	9,850.00	90 days	2½%	Feb. 20	
19.	Dec. 1	3,000.00	90 days	4½%	April 10	
20.	May 11	6,500.00	6 mos.	3%	Dec. 31	

EXERCISE No. 164, INTEREST ON DAILY BANK BALANCES

Some banks allow interest on the daily balances of checking accounts. There is no specific rule governing the method of ascertaining the interest, the calculations being based on the custom established by the bank which allows the interest. The illustration below shows one method of ascertaining interest on daily balances.

This illustration is applicable to the daily balances of the checking account of a customer of The First National Bank of San Francisco, California, during the month of September. The interest rate is 2%. The daily balances, given in the same order as the days of the month, beginning with the first and including the thirtieth, are as follows:

7.60	6.10	8.20	10.20	6.80	8.20
7.60	6.10	9.20	7.00	7.40	11.40
7.60	6.30	9.70	7.00	7.40	12.20
7.60	6.30	10.20	6.80	8.90	12.70
7.10	6.50	10.20	7.10	8.70	12.70

Total for 30 days = 250.80

The figures express thousands and hundreds. Thus, the first balance, 7.60, was \$7,613.68. All figures in the balances except those in the thousands and the hundreds columns are omitted to facilitate the interest calculations. The sum of the balances for the 30 days in September is \$250,800. In other words, this customer had on deposit in the bank what was equivalent to \$250,800 for one day. The interest on this amount at 2% for the year would be \$5,016. Since the amount is for only one day, however, it is necessary to divide it by either 360 or 365, depending on the basis used. If the amount is divided by 365, the interest would be \$13.74; if it is divided by 360, the interest would be \$13.93.

The following problems provide practice in ascertaining the interest due a customer on the daily balances of his checking

account. Add the balances without copying them and show the calculations necessary to ascertain the interest. Show the interest in each problem on a basis of (a) 365 days and (b) 360 days.

1	2	3	4	5	6
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
2%	2½%	2%	2½%	2%	2½%
13.90	33.40	48.30	61.80	110.10	98.10
13.90	33.90	48.50	61.80	110.20	97.30
14.00	34.50	49.20	85.20	110.30	95.40
15.20	34.10	49.20	89.60	115.70	89.60
14.70	34.80	48.80	97.50	115.70	89.60
14.40	34.80	49.10	108.20	118.30	87.50
14.80	37.80	51.50	100.20	114.10	84.30
15.00	38.20	56.10	100.20	112.50	85.90
15.00	38.30	56.10	116.40	112.60	87.50
15.40	38.80	56.30	113.50	99.80	82.60
16.00	39.20	56.30	98.40	98.60	78.70
16.20	39.20	57.30	95.40	98.60	78.70
16.80	39.20	57.80	90.40	96.80	76.40
18.70	39.30	59.30	98.60	95.40	75.30
19.00	40.20	59.60	98.60	93.30	74.60
19.00	40.20	59.60	97.50	94.50	74.90
19.00	40.60	59.10	98.30	99.80	78.90
21.30	41.20	59.10	94.70	96.40	85.90
22.50	41.40	60.20	94.80	96.40	85.90
23.00	41.40	60.40	93.60	97.80	87.80
23.20	44.10	60.60	96.50	98.10	86.30
24.20	44.40	60.50	96.50	98.10	87.10
24.20	44.40	61.60	96.60	99.90	80.20
26.70	44.70	61.70	99.90	95.30	82.50
27.20	46.50	61.70	104.10	97.80	82.20
27.80	47.10	61.70	104.10	97.80	82.20
28.10	47.10	62.40	104.20	96.50	84.40
29.00	47.80	62.40	103.60	99.30	89.10
29.30	47.90	62.80	103.60	—	88.70
29.30	48.30	62.80	105.10		86.40
32.50	—	61.80	106.90		81.30
—		—	—		—

EXERCISE No. 165, INTEREST ON DEPOSITS BY BANKS

When one bank deposits funds with another and interest is to be paid on the deposit, the rate of interest and the terms on which it is paid are fixed by agreement. The method of calculating the interest will be the same as the method used when notes are discounted; that is, the amount of interest due the bank that lends the money will be the interest on the principal at the given rate for the number of days the money has remained on deposit.

The following problems provide practice in calculating the amount of interest that would be paid on money deposited by a bank:

1. The First National Bank in Plymouth, Indiana, had an agreement with The Chicago City Bank and Trust Company, of Chicago, whereby it was to receive interest at 2% on amounts deposited with The Chicago City Bank and Trust Company. Below is an account showing the transactions performed by the First National Bank and The Chicago City Bank and Trust Company during a certain year.

FIRST NATIONAL BANK, PLYMOUTH, INDIANA

19—				19—			
Mar.	1		2000	Jan.	7		2000
April	17		2255 50	Feb.	29		5000
July	16		15000	Mar.	17		4000
Nov.	5		9527 48	May	16		16641 74
				July	6		17500
				Sept.	11		22565 85
				Oct.	6		16665 40
				Dec.	1		10000
				Dec.	12		12500

You are to ascertain the amount of interest that was credited to the First National Bank of Plymouth on December 31. Calculate the interest at 2% on the amounts on each side of the account up to and including December 31 and find the difference between the two sums.

2. On May 17 the Central National Bank of Cleveland, Ohio, received from the National City Bank of Akron, Ohio, a deposit of \$18,565.75. Interest at $2\frac{1}{2}\%$ was to be allowed on this amount if it remained in the bank more than three months. The amount was withdrawn on October 26. What amount of interest was due the National City Bank of Akron on that date?

3. On July 7 the Concord National Bank of Concord, Massachusetts, deposited \$47,500 with the First National Bank of Boston, with the understanding that it was to receive $1\frac{1}{2}\%$ interest from that date until the money was withdrawn. On October 6 \$10,000 was withdrawn, and the balance, on February 4 of the following year. What amount of interest was due the Concord National Bank on February 4?

Calculate the interest on the full amount from the date of deposit to the date of the first withdrawal and on the balance after the first withdrawal from the date of the withdrawal up to February 4.

4. On March 10 the Merchants & Farmers Bank of Marietta, Georgia, deposited with the Atlanta Commercial Bank of Atlanta, Georgia, \$37,500, with the understanding that it was to receive 2% interest on the amount during the time it was with the Atlanta Commercial Bank. The amount was withdrawn on July 27. How much interest was due the Merchants & Farmers Bank of Marietta when the deposit was withdrawn?

5. The Citizens National Bank of Abilene, Texas, had an account with the Central State Bank of Dallas, with the understanding that it was to receive $1\frac{1}{2}\%$ interest on the balance at the end of each month, for the number of days in the month. The following account shows a record of the transactions on the books of the Central State Bank of Dallas:

CITIZENS NATIONAL BANK, ABILENE, TEXAS

19—				19—			
May	27		5000	May	1		16875 40
June	6		3000	May	10		3542 65
July	12		8416 42	June	16		21562 50
Aug.	22		5191 81	Aug.	1		5071 20
Sept.	16		852 40	Sept.	9		9982 50
Oct.	19		2761 85	Oct.	10		11451 90
Nov.	10		1000	Nov.	16		5000
Dec.	12		5000	Dec.	5		3000

You are to find the amount of interest that was credited to the Citizens National Bank of Abilene on December 31.

EXERCISE No. 166, REDISCOUNTING NOTES

When a bank has more notes than it wishes to carry, some of these notes may be discounted at another bank and thus exchanged for cash. The federal reserve system provides that member banks

can rediscount notes at a federal reserve bank and can also take up these notes at or before maturity.

The following problems provide practice in ascertaining the present value of notes. These notes were rediscounted on September 1 at 4%. You are to show for each note: (a) the due date, (b) the discount, and (c) the present value.

NO.	DATE OF PAPER	TIME	INT. RATE	FACE	DUE DATE	DIS- COUNT	PRESENT VALUE
1.	Aug. 1	4 mos.	5%	\$22,500.00			
2.	July 10	5 mos.	6%	9,861.42			
3.	Aug. 11	3 mos.	8%	289.27			
4.	July 31	3 mos.	5%	10,000.00			
5.	Aug. 12	60 days	no	2,561.47			
6.	July 2	90 days	5%	7,061.32			
7.	Aug. 1	3 mos.	8%	247.68			
8.	July 29	90 days	7%	1,122.41			
9.	Aug. 16	2 mos.	9%	798.91			
10.	June 1	6 mos.	6%	5,000.00			
11.	Aug. 11	2 mos.	5%	14,500.00			
12.	July 26	3 mos.	6%	1,200.00			
13.	May 31	5 mos.	no	387.95			
14.	July 10	5 mos.	7%	921.32			
15.	Aug. 13	90 days	5%	5,000.00			

EXERCISE No. 167, PURCHASE OF REDISCOUNTED NOTES

The bank which rediscounted the notes in the preceding exercise on September 1 repurchased the following notes on the dates given and paid the maturity value less $4\frac{1}{2}\%$, the rate having changed since the notes were rediscounted.

NO.	NOTE NUMBER	RE- PURCHASED	PRESENT VALUE	NO.	NOTE NUMBER	RE- PURCHASED	PRESENT VALUE
1.	6	Sept. 6		6.	2	Sept. 25	
2.	9	Sept. 6		7.	5	Oct. 1	
3.	12	Sept. 14		8.	10	Oct. 1	
4.	15	Sept. 20		9.	3	Oct. 5	
5.	1	Sept. 25		10.	4	Oct. 11	

You are to show the cash required to take up these notes. The process is the same as ascertaining the present value of the notes when they were discounted except that the time and the rate have changed.

CHAPTER 49

SAVINGS BANKS

A *savings bank* is one which accepts money for deposit and agrees to pay interest on the deposit, the interest to be compounded quarterly, semi-annually, or annually. Savings banks usually pay the agreed rate of interest from the first of the month on all funds deposited during the first four days of the month. Interest is usually compounded semi-annually on January 1 and July 1. Money deposited after the fourth of the month will draw interest from the first of the month following the date of the deposit. No interest is payable for parts of a month or on parts of a dollar. Nor is interest paid for any part of the preceding half year on amounts withdrawn during the interest period. In the computation of interest, withdrawals are deducted from the balance on deposit at the beginning of the interest period, or, if that balance is not sufficient, from the first sufficient balance within the period. When interest is due and payable, and is not drawn out, it is added to the balance of the account and thereafter draws interest just as original deposits.

\$100, deposited in a savings account on September 3, at an agreed rate of 4% interest, compounded on January 1 and July 1, would earn interest at this rate during September, October, November, and December. On January 1 the interest for four months would be credited to the depositor's account. The interest at 4% on \$100 for a year is \$4; hence, the depositor's account would be credited with \$1.33 on January 1. If there were no deposits or withdrawals during the next six months, the 4% interest would be calculated on \$101 (no interest is paid on parts of a dollar). If, however, \$100 were deposited on March 2, this would draw interest at 4% through March, April, May, and June if no withdrawals were made. If, on May 3, \$50 were withdrawn, this would be deducted from the balance at the beginning of the interest period, January 1; and the \$51 left would draw interest for January and February. Since \$100 was deposited on March 2, then \$151 would draw interest during the months of March, April, May, and June. The interest on \$51 for two months at 4% is 34c. The interest on \$151 for four months at 4% is \$2.01. The depositor's account would be credited on July 1 with \$2.35 interest (34c plus \$2.01). The depositor's balance on July 1 would be \$153.68 (\$101.33 plus \$100, minus \$50, plus \$2.35), and this amount would be the principal at the beginning of the next interest period.

The following problems provide practice in ascertaining the balance due a savings bank depositor. You may assume that interest at the given rate is paid for the month on all deposits made on or before the fourth of the month and that the calculations are based on 1 month as $\frac{1}{12}$ of a year, 6 months as $\frac{1}{2}$ of a year, etc.

1. On July 1 Harry Davis deposited \$50 in the Central Savings Bank. This bank pays 4% interest and credits the interest on July 1 and January 1 of each year. Mr. Davis made the following deposits: August 3, \$200; September 1, \$50; September 28, \$50; October 3, \$25; November 15, \$100; January 2, \$100; February 5, \$50; March 1, \$100; April 5, \$50; May 1, \$100; and June 1, \$50. How much did he have in the bank on July 1 after his account had been credited for the interest on the deposits?

2. The following is a record of the transactions which George H. Dutch performed with the savings department of the First National Bank during the period covered by the transactions. You are to ascertain the amount due on July 1 of the second year if interest was compounded on January 1 and July 1 at 4%. January 2, balance, \$261.85; January 5, deposited \$75; February 3, deposited \$50; February 25, deposited \$50; March 3, deposited \$100; April 2, deposited \$250; May 1, withdrew \$150; May 16, deposited \$50; July 3, deposited \$100; August 1, deposited \$200; October 5, deposited \$100; December 1, deposited \$100; January 6, deposited \$50; February 3, deposited \$100; April 1, deposited \$50; June 1, deposited \$50.

3. A. C. Mabley opened an account in the savings department of the City National Bank on February 1. He made a deposit of \$100 on that date and completed the following transactions during the remainder of the year: March 3, deposited \$500; April 5, deposited \$1,000; May 1, withdrew \$500; June 1, deposited \$300; July 15, withdrew \$200; August 4, deposited \$1,000; September 3, deposited \$500; October 1, withdrew \$1,000; October 5, deposited \$200; November 1, deposited \$200; December 5, deposited \$500; December 20, withdrew \$200. Ascertain the balance due Mr. Mabley on January 1 after his account had been credited on July 1 and January 1 for interest at 4%.

4. L. W. Peart deposited \$1,000 in the Central Savings Bank on January 1. On March 1, 5 years and 2 months thereafter, he

called at the bank to withdraw the amount due him. How much did he receive if the rate of interest was $3\frac{1}{2}\%$, compounded on July 1 and January 1 of each year?

5. Mary E. Watson opened an account in the savings department of the Fourth National Bank on January 2. She made a deposit of \$10 on that date and deposited the same amount thereafter on the first of each month. How much was due at the end of 3 years if interest at 4% was compounded semi-annually on January 1 and July 1?

6. Copy the following account and (a) insert the proper amounts of interest for January 1 and July 1; (b) find the balance due Mr. Muir on July 1. You may assume that interest was compounded semi-annually at 4% .

EDWARD G. MUIR

19—				19—			
Oct.	3	Withdrawal	200 00	July	1	Balance	236 65
19—					2	Deposit	50 00
Jan.	1	Withdrawal	100 00	Sept.	12	Deposit	50 00
				Dec.	2	Deposit	150 00
				19—			
				Jan.	1	Interest	? ?
					5	Deposit	200 00
				Mar.	1	Deposit	50 00
				April	1	Deposit	50 00
				July	1	Interest	? ?

CHAPTER 50

SCHOOL SAVINGS BANKS

Purpose. A school savings bank is run, primarily, to give the pupil an opportunity to deposit money regularly, and thus to inculcate the habit of saving.

The operation of such a bank also provides valuable and practical training, on a small scale, in the essentials of a business office and of banking methods. It provides a definite unit of work that involves the actual handling of money, reports that must balance, a knowledge of business forms, and the use of adding machines.

Organization. The organization of a school banking system is as follows:

(a) Collector: Student collectors are appointed to go to the various schools on assigned banking days. They deal directly with the teacher.

(b) Poster: The poster attends to the clerical and bookkeeping work.

American Trust Company				Number _____ In account with			
School Savings Branch				<u>Brown, Thomas</u>			
Date	Withdrawals	Deposits	Balance	Date	Withdrawals	Deposits	Balance
19- Dec 2	Balance b/d	100	31 45	1- Feb 25	Balance b/d	100	24 87
9		50	31 75	1- Mar 3		35	30 22
16		35	32 30	10		90	31 12
20	100	35	32 65	17		35	31 47
Dec 31, 19		25 65	25 65	24		75	32 22
19- Jan 6	Interest	27	25 92	31, 19		00	33 22
13		30	30 22	Jan 31, 19	Interest	29	33 51
20		55	30 77	Apr 7		45	33 96
27		30	31 07	14		30	34 26
Feb 4		30	31 37	21		55	34 81
11	200	25	31 62	28		75	35 56
18		25	29 87				

Pass Book for a School Savings Bank

ALAMEDA CITY SCHOOLS SAVINGS SYSTEM TEACHERS' REPORT OF RECEIPTS ORIGINAL (Headquarters)						
(HEADQUARTERS-ALAMEDA HIGH SCHOOL)						
School	Date	Signed	Teacher			
I have guaranteed the accuracy of the amounts deposited below and (2) have entered the same into the (1) ledger or account book. The resulting balance on the credit book agrees with the balance indicated on this sheet (3).						
Grade	8	Signed	Miss Smith	Teacher		
		1	2	3		
Pupil Depositing	New	Amount Deposited	Balance on Date	Posted	Audited	
1 Brown Thomas		50	31/95			
2 Crawford Bernard		10	48/75			
3 Holmes Boris		1 00	58/50			
4 Kimball Ruth		50	78/30			
5 Miller James		10	26/21			
6 Watkins George		30	50/50			
7 Kramer Frances		05	57/60			
8 Ryder Carol		25	62/50			
9 Hammond Harold		10	75/00			
10 Herman Hazel		15	30/55			
11						
12						
Total Deposits Collected		\$ 2 95				
Approved by _____						
NOTE ALL TRANSFERS on Reverse Side						

Report of Receipts for a School Savings Bank

the pupil and enters it in the pass book (Page 243). This amount is entered on a teacher's report of receipts. When the list is completed, it is totaled, and the total is compared with the amount of money received. The teacher's report and the money are sent to the principal's office, where the school collector (bank teller) verifies the addition of the teacher's report and the count of the money. The money is then deposited in the city bank, and the teacher's report of receipts is brought to the school banking headquarters for posting and filing.

(b) Posting: This operation involves the transferring of the original deposit records to individual ledger cards, one of which is kept for every depositor.

(c) Making withdrawals: A withdrawal calls for the preparation of a withdrawal slip. This slip is filled out and presented to the banking headquarters. The pupil receives his money and an

(c) Auditor: The auditor verifies the accuracy of the poster's work.

(d) Cashier: One or more student cashiers are responsible for withdrawals and the balancing of reports.

Operation of a school banking department. The important divisions of work in a school bank may be classified as follows: (a) receiving deposits; (b) posting; (c) making withdrawals, (d) compiling reports.

(a) Receiving deposits: The teacher receives the deposit from the pupil and enters it in the pass book (Page 243). This amount is entered on a teacher's report of receipts. When the list is completed, it is totaled, and the total is compared with the amount of money received. The teacher's report and the money are sent to the principal's office, where the school collector (bank teller) verifies the addition of the teacher's report and the count of the money. The money is then deposited in the city bank, and the teacher's report of receipts is brought to the school banking headquarters for posting and filing.

No. _____ School Savings BANK						
IN ACCOUNT WITH _____						
School _____						
Cust. A. J. Smith						
Date	Withdrawals	Deposits	Balance	v	Remarks	
Jan 19	Balance b/d	50	31/45			
Dec 2		50	31/95			
9		35	32/30			
16		35	32/65			
20	3 00		29/65			
Jan 19	27		29/38			
6	30		30/28			
12	55		30/77			
20	30		31/07			
27	30		31/37			
4	25		31/62			
11	2 00		29/62			
18	25		29/77			
25	35		30/22			
Mar 3	20		31/22			
10	35		31/47			
17	75		32/22			
24	1 00		33/22			
Mar 31	29		33/51			
Apr 7	45		33/96			
14	30		34/26			
21	55		34/81			
28	75		35/56			
BALANCE FORWARD						

Individual Ledger Card for a School Savings Bank

entry showing the amount withdrawn is made in the pass book and on the ledger card.

(d) Compiling reports: At the end of each month an adding machine list is made of the individual ledger card balances. This total must agree with the balance of the school's account in the savings bank, known as the *control account*. Weekly withdrawal reports, showing itemized lists of withdrawals, are kept on file.

WITHDRAWAL Schools Savings System	
Date <u>Dec. 20, 19</u> - School _____	Grade <u>A 8</u>
Received from <u>School Savings Bank</u> (\$ <u>3.00</u>)	
<u>Three and</u> _____	(Bank) _____
(Write)	no/100 Dollars
Leaving Balance \$ <u>29.65</u>	
Approved <u>H. P. Cross</u>	
Principal	
Account audited & authorized paid by <u>Thomas Brown</u>	
Pupil	
<u>G. R. Brown</u>	
Parent or Guardian	

Withdrawal Slip for a School Savings Bank

Interest. The prevailing rate of interest is figured on school savings accounts. The amount of interest may be calculated just as in ordinary savings accounts previously discussed. Ordinarily, however, the interest is calculated on the number of whole dollars on the lowest balance in each quarter. The first quarter includes January, February, and March; the second, April, May and June; the third, July, August, and September; and the fourth, October, November, and December. If a deposit is made on or before the tenth day of the first month of a quarter, the lowest balance in the quarter is figured as if the deposit had been made on the first of the month.

Example: In the illustration on page 243, interest is calculated at the rate of 4% a year, or 1% a quarter. The interest credited on March 31 was found as follows:

Lowest balance in the third quarter, \$29.62.

Lowest balance (whole dollars), $\$29 \times .01 = \$.29$, interest due on March 31.

In the problems in this chapter, interest will be calculated at the rate of 4% a year on the lowest balance in each quarter but interest will be credited to the deposits only on December 31 and June 30.

1. Lucille Blake's balance on January 2 was \$22.66. Deposits were made as follows: January 18, \$1.50; February 3, \$1.25; March 1, \$1.75; April 10, \$2.00; May 21, \$1.50. (a) How much interest was credited to her account on June 30? (b) What was the total of her account on June 30?

NOTE: In solving each of the problems in this chapter you will find it helpful to prepare a ledger card similar to the one illustrated on page 244.

2. Bernard Chase's balance on June 5 was \$65.90. He made deposits as follows: July 12, \$3.50; September 5, \$3.00; October 20, \$5.50; November 6, \$4. On August 16 he withdrew \$2.75. What was the balance of Bernard's account on December 31?

3. How much interest did Bernard Chase receive on the following December 31 if he made no more deposits or withdrawals?

4. Helen Brown's balance on August 1 was \$50.10. She made deposits as follows: September 3, \$6.50; September 25, \$3.00; October 17, \$5.50; November 6, \$6.50; November 24, \$5; December 9, \$7. (a) How much interest was credited to her account on December 31? (b) What was the total of her account on December 31?

5. John Emery's balance on April 3 was \$97.80. He made deposits as follows: April 19, \$5; May 10, \$3.75; June 23, \$5; September 9, \$7.50; October 13, \$5; November 21, \$7.50. On June 10 he withdrew \$15; and on December 2, \$25. What was the balance of John's account on June 30? on December 31?

6. Elizabeth Crane's balance on January 2 was \$65. She made deposits as follows: February 1, \$9; March 10, \$3.50; April 5, \$4; May 6, \$5.25; June 24, \$3.50; August 17, \$5.60; September 30, \$7.50; November 2, \$2.50. On June 1 she withdrew \$10; and on October 7, \$15. What was the balance of Elizabeth's account on June 30? on December 31?

7. Ralph Neiporte's balance on September 10 was \$88.40. He made deposits as follows: October 1, \$5; November 3, \$6.50;

December 10, \$3.50; February 18, \$7.50; March 20, \$6; May 13, \$6. On January 3 he withdrew \$15; and on April 14, \$9. What was the balance of Ralph's account on December 31? on June 30?

8. Walter Gibson's balance on March 31 was \$111. He made deposits as follows: April 1, \$4.50; May 3, \$5; June 7, \$4.75; August 15, \$10; September 9, \$6; October 8, \$7; December 15, \$8. On July 14 he withdrew \$10; and on November 1, \$8. What was the balance of Walter's account on June 30? on December 31?

9. Alice Long's balance on January 2 was \$94.50. She made deposits as follows: January 11, \$5; February 13, \$6.50; April 8, \$4.00; May 3, \$5; July 6, \$4.50; August 7, \$3.50; September 13, \$6; November 11, \$10. On March 6 she withdrew \$7; on June 10, \$10; on October 9, \$6. What was the balance of Alice's account on June 30? on December 31?

10. Harold Cummins' balance on October 1 was \$87.75. He made deposits as follows: October 10, \$8; November 3, \$6.50; January 10, \$3; February 9, \$5; March 13, \$7.50; May 9, \$5; May 28, \$4; June 15, \$3.50. On December 14, he withdrew \$15; on April 1, \$6; and on June 20, \$4. What was the balance of Harold's account on December 31? on June 30?

CHAPTER 51

PARTIAL PAYMENTS

When only a part payment is made on a note, the date and the amount paid should be written on the back of the note. This writing is referred to as *indorsing for part payment*. When a note is paid in two or more payments, it is necessary to adjust the interest at the time the balance of the note is paid. There are two methods of making this adjustment: one is known as the *merchants' rule*; and the other as the *United States rule*. The method to be followed will depend upon the agreement or the law covering partial payments in the state in which the maker resides.

Merchants' rule. This rule requires the holder of the note to calculate interest on the face of the note from the time it began to draw interest until the date it was paid in full, and allows him to deduct from the face of the note plus interest, the sum of the payments plus the interest on each payment from the date the payment was made to the day of settlement.

The illustration below shows the calculations necessary to ascertain the amount due on a note of \$500, dated May 16, with interest at 6%, and with the following payments entered on the back: August 14, \$125; September 30, \$100; November 24, \$50. The maker wishes to pay the note in full on December 31 of the same year. Settlement according to the merchants' rule is agreed upon.

Face of note.....	\$500.00
Interest on \$500 from May 16 to Dec. 31, 229 days.....	19.08
Amount due on Dec. 31 if no payments had been made.....	\$519.08

INTEREST ON PAYMENTS

Interest from Aug. 14 to Dec. 31, 139 days, on \$125,	\$2.90
Interest from Sept. 30 to Dec. 31, 92 days, on 100,	1.53
Interest from Nov. 24 to Dec. 31, 37 days, on 50,	.31

$$\begin{array}{r} \text{\$275} + \text{\$4.74} = 279.74 \end{array}$$

Amount due on Dec. 31 after payments are deducted.....	\$239.34
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United States rule. This title is given to the rule, because it was first used by the United States Government when payments and interest were involved; its approval by the Supreme Court of the United States has resulted in its legal adoption by many states. The United States rule is usually employed when partial payments are made on an interest-bearing note, the time of which exceeds one year. When this rule is used, the date and the amount of each payment are entered on the back of the note as a receipt.

When the amount due at any particular time is to be found, interest is calculated on the original principal from the date of the note until the time of the first payment. The payment is then subtracted from the sum of the principal and the interest. The amount thus found is the principal on which interest is calculated until the second payment is made. This principal and the interest are added, and the second payment is subtracted. The same plan is continued until the time is reached for which the amount due on the note is desired.

The following illustration shows the method of finding the amount due according to the United States rule on the note used in the illustration on page 248.

Face of note.....	\$500.00
Interest from May 16 to Aug. 14, 90 days, on \$500.....	7.50
Amount due, August 14.....	507.50
Less payment, August 14.....	125.00
New principal, August 14.....	382.50
Interest from Aug. 14 to Sept. 30, 47 days, on \$382.50.....	3.00
Amount due, September 30.....	385.50
Less payment, September 30.....	100.00
New principal, September 30.....	285.50
Interest from Sept. 30 to Nov. 24, 55 days, on \$285.50.....	2.62
Amount due, November 24.....	288.12
Less payment, November 24.....	50.00
New principal, November 24.....	238.12
Int. from Nov. 24 to Dec. 31, 37 days, on \$238.12.....	1.47
Amount due, December 31.....	239.59

Check this illustration with the facts given in the other illustration and compare the two methods.

You will observe that the amount due on the date of the first payment is \$500, the face of the note, and \$7.50, the amount of the interest. The payment of \$125 is deducted from this total, and the new principal of \$382.50 is used as the base for calculating

the interest from the date of the first payment to the date of the second payment. This process is the same as subtracting the interest from the payment and subtracting this balance from the face of the note to ascertain the balance due on the note, or the new principal.

The interest on the new principal, \$382.50, from August 14, the date of the first payment, to September 30, the date of the second payment, is \$3. The total amount is, then, \$385.50. Deducting the payment of \$100 made on September 30 leaves a balance of \$285.50.

The interest on the new principal, \$285.50, from September 30 to November 24, the date of the third payment, is \$2.62. The total amount due on November 24 is, then, \$288.12. Deducting the payment of \$50 made on November 24 leaves a balance of \$238.12, the new principal on which interest is calculated.

Since no further payments are made after November 24, the amount of interest due on December 31 is \$1.47. The total amount due is \$239.59.

The problems on this and the following pages provide practice in ascertaining the amount due on the date of settlement when interest and partial payments are involved. Solve each problem according to the merchants' rule and the United States rule. Show all calculations necessary to ascertain the amount due according to each rule.

1. Richard R. Carter gave J. P. Sharp a 90-day note for \$2,400, dated August 14 and payable at the office of Sharp. The note bore 6% interest. Payments were made as follows: September 15, \$850; October 30, \$420; November 4, \$1,140. Find the amount due at maturity.

2. M. M. Berning and E. A. Ohlhauser gave a six-month 6% interest-bearing note, dated June 4, for \$4,800 to W. T. Briggs. It was payable at the Mechanics and Farmers Bank. Find the balance paid on April 11 of the following year if \$2,000 was paid on the due date of December 4, and \$1,800 was paid on March 18.

3. J. H. Davis received a demand note for \$40.80, signed by W. K. Stewart, dated June 16, and bearing 6% interest. The note was payable at the State National Bank. Indorsements of payments were recorded as follows: \$15.40 paid on July 5; \$8.12 paid on August 12; and \$2.25 paid on September 30. Find the balance due and paid on November 4.

4. Find balance due at maturity on the following note. See the indorsements on the next page.

\$650 ⁰⁰	Chattanooga, Tenn.	Mar. 10 19
	August 19	after date I promise to pay to
	the order of	H. M. Kern
	Six Hundred Fifty	Dollars
	at Union Savings Bank & Trust Co.	
	Value received	Int 4%
No. 3	Due	H. A. Kemball

5. What is the amount due on October 30 on the following note?

\$900 ⁰⁰	ST. LOUIS,	Jan 2 19
	October 30	after date I promise to pay to
	the order of	V. M. Rubert
	Nine Hundred	Dollars
	at City Hall Bank	
	Value received	Int 5%
No. 21	Due	W. O. Crosswhite

6. What is the amount due on December 1 on the following note?

\$468.12	HUNTINGTON, W. VA.	May 1, 19
	Five months	after date I promise to pay to
	the order of	Pearl Diorio
	Four Hundred Sixty-eight and	12/100 Dollars
	at Union National Bank	
	Value received	Interest at 6%
No. 2	Due	Gouinne H. Ernst

April 30, 19	\$150.00
June 3, 19	250.00

May 8, 19	\$1.00
July 15, 19	150
Aug 2, 19	200

July 1, 19	100.00
Aug. 1, 19	100.00
Sept. 1, 19	100.00
Nov. 1, 19	100.00

Endorsements of payments on notes on previous page.

CHAPTER 52

INTEREST REVIEW PROBLEMS

The following problems provide practice in applying the principles discussed in the preceding chapters.

1. Smith Bros. owe the Regal Shoe Company \$2,762.85, but they cannot pay the amount now. The Regal Shoe Company agrees to allow 60 days additional provided Smith Bros. will give the company a note for an amount which, when discounted at the bank at 6%, will pay the balance of the account. Smith Bros. accept the proposition and execute the note on May 16. Find the face of this note.

NOTE: When no reference is made to interest in connection with a note, the note is interpreted as a non-interest-bearing note.

2. The note shown below was discounted at the First National Bank on April 27 at 8%, and the proceeds were placed to the credit of Mr. Ingleke. What amount was credited to his account?

	\$ 361.27	Denver, Colo.	April 4, 19
	Three months after date I promise to pay to		
	the order of J. C. Ingleke		
	Three hundred sixty-one and - - - - - 27/100 Dollars		
	at First National Bank		
	Value received with interest at 6%		
No 123	Due	Laura Guilford	

NOTE: It is the usual custom of banks to count the actual number of days between the date and the maturity of a note, in ascertaining the maturity value, and the actual number of days between the date on which the note was discounted and the maturity, in ascertaining the discount. This note matures on a holiday; hence, it cannot be collected until the following day.

3. On January 16 O. C. Barber, of Huntsville, Alabama, borrowed \$500 from the First National Bank of Huntsville and gave in evidence of the loan an interest-bearing note due in 90 days. The note was not paid when due, and legal proceedings were

necessary to collect it. On October 16 of the same year, a judgment was awarded to the First National Bank for the note and the accrued interest. What was the amount of this judgment if it included interest at 8% to October 16 and the court costs of \$27.50?

4. A boy has \$500 deposited to his credit in the Citizens Mutual Savings Bank on his tenth birthday. The bank pays $5\frac{1}{2}\%$ interest, compounded semi-annually. What will be the amount placed to the boy's credit on his fifteenth birthday if the principal and the interest remain undisturbed in the bank?

5. J. H. Johnson sold a house and lot to G. E. Smith for \$5,500. He received \$3,800 in cash, and he was to receive the balance in monthly installments of \$100 each plus the accrued interest at 6% on the unpaid balance. Mr. Smith was given permission to pay the full amount due on the first of any month; at that time he would receive a deed for the property. He paid the balance in full when he made the sixth payment. What was the amount of that payment?

NOTE: You may assume that each month is $\frac{1}{12}$ of a year and that the first monthly payment included the interest on \$1,700 for $\frac{1}{12}$ of a year; the second monthly payment included the interest on the new principal for $\frac{1}{12}$ of a year; etc.

6. On June 1 James Dooley purchased a home from the Mayo Realty Company for \$7,000. He paid \$2,500 in cash and agreed to pay the balance in monthly installments of \$75. He also agreed to pay interest quarterly on July 1, October 1, January 1, and April 1. The interest was to be calculated at the rate of 6% on the principal of the debt during each month. Mr. Dooley had the privilege of paying any amount he desired in excess of \$75 on July 1 and January 1.

The following is a list of the payments made by Mr. Dooley: July, August, September, October, November, and December, \$75 each; January, \$500; February, March, April, May, and June, \$75 each; July, \$300; August, September, October, November, and December, \$75 each; January, in full. What amounts were paid on July 1 and January 1 of each year?

7. On March 6 Robert Downing purchased from Moore Bros. on 30 days' time merchandise amounting to \$412.85. This invoice was not paid at maturity, and it was necessary to bring a

suit to make collection. The court rendered a judgment on October 12 of the same year for the amount of the claim and interest at 6% from maturity. What was the amount of the judgment if it included court costs of \$21.80?

8. How long will it take \$3,627.92 to produce \$55.63 interest (a) at 6%? (b) at 8%? (c) at 4%?

9. J. T. Burnet owned four notes of \$500 each, received by him in payment of a house and lot sold to E. H. Fagley. Each note was dated January 1; and they were due in six, twelve, eighteen, and twenty-four months respectively, with interest at 6%. Mr. Fagley had the privilege of paying more than \$500 at the maturity of any one of the notes. On July 1, when the first note was due, he paid it in full. On January 1, when the second note was due, he paid it in full and \$100 on the third note. On July 1, when the third note was due, he paid the balance on it and \$200 on the fourth note. On January 1, when the fourth note was due, he borrowed sufficient money from his bank to pay the balance due Mr. Burnet. You are to ascertain: (a) the amount paid when the first note was due; (b) the amount paid when the second note was due; (c) the amount paid at the time the third note was due; (d) the amount of the ninety-day note which Mr. Fagley gave to his bank to secure funds to pay the balance on the fourth note, the face of this note being an amount which, when discounted at 8% for ninety days, would produce the balance due Mr. Burnet.

10. R. K. Bloom purchased a home for \$6,000. He had \$3,000 in cash with which to make payment and borrowed an additional \$3,000 at the rate of $6\frac{1}{2}\%$. The assessed valuation on the house and lot was \$4,500, and the tax rate was \$24 a thousand. The water rate was \$15 a year, and the insurance on the house was \$25 a year. Mr. Bloom could have invested his \$3,000 so that it would earn 6%. How much did it cost him each month to own his home? You need not take depreciation or upkeep into consideration.

11. J. H. Snyder purchased a radio for \$350. He paid \$50 in cash and the balance at \$25 a month on the first of each month; interest at 6% on the principal was paid in addition to the monthly payments. You are to ascertain: (a) the amount paid each month:

(b) the total cost of the radio, including the purchase price and the interest.

12. What will be the value of a note for \$500, dated May 1, due in ninety days, and bearing interest at 6% (a) on May 27? (b) on June 16? (c) on July 1?

13. James Brown borrowed \$25,000 from the Central Trust Company and gave as security a mortgage on a flat building which he owned. He was to pay 5% interest semi-annually and to execute a five-year note for the principal and 10 notes for the semi-annual interest on the entire loan. You are to ascertain: (a) the face of each interest note; (b) the total amount of interest paid on this loan.

14. J. J. Alderson inherits the property at 729 May Street. This property contains six apartments which rent for the following amounts for each month: Apartments A, B, and C, \$85 each; Apartments D and E, \$75 each; and Apartment F, \$65. The average expense of maintaining the property during the past 5 years has been \$52.50 a month. What should be the market value of this property if Mr. Alderson wishes his money to earn 8%?

15. Frank Finn collected \$42.65 interest on a loan for 87 days at 7%. What was the amount of the loan?

16. The amount of a certain principal at a certain rate for 3 years is \$302.50, and the same principal at the same rate for 5 years is \$337.50. You are to ascertain: (a) the principal and (b) the rate of interest.

17. C. C. Carpenter presented his daughter with ten \$1,000, 10-year, $5\frac{1}{2}\%$ bonds on her tenth birthday, July 1. How much will she have at the maturity of these bonds if the semi-annual interest payable on July 1 and January 1 is deposited in a bank where interest at 5%, compounded annually, is allowed?

18. On August 6 the Miller Bros. Co. sold merchandise to A. L. Jenkins for \$781.65. On August 10 Mr. Jenkins accepted a 90-day trade acceptance for an amount which, when discounted at 6%, would pay the amount of this bill less 2%. What was the face of the trade acceptance?

19. What amount will Mr. Phillip receive for the following note if it is discounted at the First National Bank on July 1 at 8%?

\$ 427.80	EASTON, PA.	May 16, 19
Ninety days	after date I promise to pay to	
the order of	L. A. Phillip	
Four hundred twenty-seven and	80/100 Dollars	
at First National Bank		
Value received with interest at 6%		
No. 146	Due	G. C. Atwater

20. The First National Bank offered to discount this note on August 1 at 8%. The discount was to be calculated on the maturity value of the note, counting the actual number of days between the date and maturity. The Citizens Bank offers to discount the note at the same rate and to consider the maturity value as the face plus interest for 4 months, or $\frac{1}{3}$ of a year. You are to ascertain: (a) the proceeds of the note if it is discounted at the First National Bank; (b) the proceeds if the note is discounted at the Citizens Bank; and (c) the difference between the two amounts.

\$ 2000.00	MINNEAPOLIS, MINN.	July 1, 19
Four months	after date I promise to pay to	
the order of	C. C. Duggan	
Two thousand	Dollars	
at First National bank		
Value received with interest at 6%		
No. 221	Due	M. H. Pierson

UNIT 9

BUSINESS PRACTICE

CHAPTER 53

PROBLEMS OF A MERCHANT

The problems of a merchant are varied and numerous. Some of them have been illustrated previously; others will be illustrated in this chapter. These problems require the use of fractions, aliquot parts, percentage, and interest.

EXERCISE No. 168, PROFIT ON MERCHANDISE SOLD

It is not always possible for the merchant to know the exact cost of merchandise sold in each sale; but to ascertain his profit, he must know the total cost of all sales. This information is usually ascertained at least once each business year. To determine the cost of merchandise sold and the profit made by selling, it is necessary to record the value of merchandise on hand at the beginning of the year (referred to as the *beginning inventory*), the purchases during the year (referred to as *purchases*), the sales during the year (referred to as *sales*), and the value of merchandise on hand at the end of the year (referred to as the *ending inventory*). When these facts are available, the profit made by selling merchandise throughout the year (referred to as *profit on sales*) can be ascertained by addition and subtraction.

The illustration below shows the method of ascertaining: (a) the cost of merchandise sold; (b) the profit on the goods sold.

Sales.....		\$18,987.00
Beginning Inventory.....	\$ 3,427.65	
Purchases.....	12,192.00	
Cost of Merchandise Available for Sale.....	15,619.65	
Ending Inventory.....	3,116.65	
Cost of Merchandise Sold.....		12,503.00
Profit on Sales.....		\$ 6,484.00

The sales are shown first, because the cost of the merchandise sold is to be subtracted to find the profit on sales. The sum of the beginning inventory and the purchases is the value of the merchandise available for sale. The difference between the value of the merchandise available for sale and the ending inventory is the cost of the merchandise sold. The difference between the sales and the cost of the merchandise sold is the profit on sales.

If the cost of the merchandise sold is more than the sales, the difference between the sales and the cost is a loss.

The following problems provide practice in ascertaining the profit or the loss on the merchandise sold during a business year. Arrange your work in the same form as that in the illustration.

	Beginning Inventory	Purchases	Sales	Ending Inventory
1.	\$2,782.11	\$ 6,941.66	\$12,722.81	\$2,642.11
2.	5,421.65	10,786.50	20,465.54	7,511.18
3.	4,005.52	12,076.55	25,581.19	1,276.54
4.	7,926.42	10,029.17	18,041.55	2,165.11
5.	562.55	9,487.36	15,078.91	1,005.76
6.	1,751.36	5,649.54	16,129.86	705.30
7.	2,020.20	6,979.59	22,201.36	1,591.12
8.	7,256.91	13,764.18	18,007.63	1,741.15

EXERCISE No. 169, PROFIT ON MERCHANDISE SOLD

The merchandise which a merchant has bought and which he returns to the one from whom it was purchased is referred to as *purchases returns*. The merchandise which a merchant has sold and which is returned to him by his customer is referred to as *sales returns*. The total of all purchases is called the *gross purchases*. The difference between the gross purchases and the purchases returns is called the *net purchases*. The total of all sales is called the *gross sales*. The difference between the gross sales and the sales returns is called the *net sales*.

The illustration on page 260 shows one method of arriving at the net cost of merchandise sold when purchases returns and sales returns are involved. The facts involved are as follows: gross sales, \$25,927.36; sales returns, \$675.36; beginning inventory, \$3,227.66; gross purchases, \$8,721.94; purchases returns, \$964.78; ending inventory, \$2,165.42. The facts regarding the sales are shown first to facilitate subtraction.

Gross Sales	\$25,927.36	
Less Sales Returns	675.36	
Net Sales		\$25,252.00
Beginning Inventory	3,227.66	
Gross Purchases	\$8,721.94	
Less Purchases Returns	964.78	
Net Purchases	7,757.16	
Cost of Merchandise Available for Sale	10,984.82	
Less Ending Inventory	2,165.42	
Cost of Merchandise Sold		8,819.40
Profit on Sales		\$16,432.60

The following problems provide practice in ascertaining the profit on merchandise sold during a business year when returned purchases and returned sales are involved. Arrange your work in the same form as that in the illustration.

	BEGIN. INVENT.	PURCHASES	PUR. RET.	SALES	SALES RET.	END. INVENT.
1.	\$1,654.55	\$ 5,446.25	\$125.68	\$16,146.25	\$234.47	\$ 608.28
2.	5,623.64	10,784.48	135.45	20,756.82	178.36	7,566.35
3.	7,845.56	10,147.58	243.55	18,467.28	204.57	2,574.81
4.	8,256.93	14,764.38	225.53	19,008.38	89.84	1,842.75
5.	2,782.13	8,465.67	147.62	13,584.27	148.56	2,563.18
6.	3,034.16	7,784.47	203.32	23,487.90	189.98	2,438.75
7.	664.47	9,574.57	74.32	15,473.72	88.82	1,014.55

EXERCISE No. 170, RATE PER CENT OF RETURNED MERCHANDISE

Perhaps the best method of presenting to the owner of a business the facts regarding purchases returns and sales returns is to express each in the form of a rate per cent. The gross purchases are used as a base in ascertaining the rate per cent of the merchandise returned by the owner; the gross sales are used as a base in ascertaining the rate per cent of the merchandise returned by customers.

The following problems provide practice in presenting to the merchant, in percentage form, facts regarding merchandise returned to those from whom he bought it and that returned to him by his customers.

1. During the first six months of a business year, the Johnson Company bought merchandise amounting to \$29,675.87, and returned merchandise amounting to \$1,362.55 to those from whom it was bought. During the next six months of the same year, the gross purchases were \$37,902.51 and the purchases returns, \$1,675.92. You are to ascertain: (a) the rate per cent of returns for each of these two periods; (b) the increase or decrease in the percentage of the returns. Show this as a rate per cent.

2. The sales and the sales returns as recorded on the books of the May Drug Company during two consecutive years were as follows:

Sales for the first year.....	\$116,581.42
Sales returns.....	3,471.65
Sales for the second year.....	142,518.92
Sales returns.....	4,527.99

You are to ascertain: (a) the per cent of returns for each year; (b) the increase or decrease in the percentage of the returns.

3. The total sales of the Martin Department Store for a year were \$1,961,781, and the sales returns were \$9,182.25. What per cent of the sales were the sales returns?

4. The Peters' Grocery Company's purchases for one year were \$77,417.45, and the purchases returns were \$3,721.92. What per cent of the goods purchased was returned?

5. The net sales of the Simrall Company, after the returns had been deducted, were \$87,516.48. If the returns were $1\frac{3}{4}\%$ of the gross sales, what were the total sales?

6. The sales returns of the Quick Service Hat Company during one year were \$187.65. If this amount was $1\frac{1}{2}\%$ of the net sales, how much were (a) the net sales? (b) the gross sales?

7. The gross sales of the Williams Company for a month amounted to \$18,751.41, and the sales returns, to \$2,161.75. What per cent of the gross sales was returned?

8. The gross purchases of the Hart Hardware Company for a year amounted to \$40,400.55, and the purchases returns were \$750.50. What per cent of the gross purchases was returned?

EXERCISE No. 171, FREIGHT COST

A merchant is interested in the freight cost of the merchandise he buys, because this is a direct increase in the cost of the merchandise. When comparing quotations, he must take into consideration freight cost as well as the prices quoted, unless the prices are *f.o.b.* the buyer's freight station.

NOTE: *f.o.b.* means free on board. If the terms are *f.o.b.* the seller's freight station, the buyer pays the freight; if the terms are *f.o.b.* the buyer's freight station, the seller pays the freight.

The following problems provide practice in obtaining the desired information regarding freight cost and in determining its effect on the cost of merchandise to be purchased:

1. Robert Biddle, a miller, wishes to buy 1,200 bushels of wheat. He receives prices from three bidders located in different cities. Bidder No. 1 quotes a price of \$1.07 a bushel, *f.o.b.* his freight station; Bidder No. 2, \$1.13 $\frac{3}{4}$, *f.o.b.* his freight station; Bidder No. 3, \$1.04, *f.o.b.* his freight station. The freight rate on wheat from the freight station of Bidder No. 1 is \$1.55 $\frac{1}{4}$ a hundred pounds; from that of Bidder No. 2, \$1.35 $\frac{1}{2}$; from that of Bidder No. 3, \$1.65 $\frac{3}{4}$. You are to show all the calculations necessary to find the net cost of the wheat if it were purchased from each bidder. Designate the results in order, beginning with the lowest net delivered price.

NOTE: A bushel of wheat weighs 60 pounds.

2. The amount of an invoice was \$762.48, and the freight was \$35.20. What per cent of the invoice cost was the freight?

3. If the merchandise in Problem 2 could have been purchased from a company not so far away, and thus a saving of \$15.65 could have been effected in the freight, what would have been the per cent of saving (a) on the freight? (b) on the merchandise cost?

4. The freight rate on a consignment of merchandise was 87 $\frac{3}{4}$ c a hundred pounds. What was the amount of the freight if the shipment weighed 21,642 pounds?

5. The Day Company received from the C. & P. Railroad a check for \$12.65, a refund because of an error in a freight bill. If this check was 7 $\frac{1}{2}$ % of the freight paid, how much freight was paid?

6. The first-class freight rate between two cities was $77\frac{1}{2}c$. The Interstate Commerce Commission ordered a reduction to $71\frac{1}{2}c$. What was the per cent of saving because of that reduction?

7. \$270.80 was paid as freight on a shipment weighing 37,352 pounds. What was the rate a hundred pounds?

8. If the freight rate between two cities is $47\frac{1}{2}c$ a hundred pounds, and the express rate is \$1.75 a hundred pounds, what will be the per cent of saving by sending by freight a shipment weighing 564 pounds?

EXERCISE No. 172, TURNOVER

Turnover refers to the number of times a merchant sells his stock during a year. It is quite evident that the turnover is not so rapid in some lines of business as in others. A grocer will buy and sell bread or sugar more times during a year than a piano merchant will buy and sell pianos. A number of statistical papers have been prepared on the turnover of various lines of business. The information given in these tables is based on the actual experiences of merchants engaged in these kinds of businesses over a period of many years. The following average turnover rates were reported by the Bureau of Business of A. W. Shaw & Co.

General Lines		Departmental Lines	
	Turns Each Year		Turns Each Year
Grocery Store	10.0	Notions	9.0
Department Store	7.0	Women's Ready to Wear	6.0
Variety Store	6.0	Wall Paper	4.2
Drug Store	4.5	Men's Furnishings	4.2
Dry Goods Store	4.0	Underwear	4.1
Hardware Store	3.5	Hosiery	4.0
Furniture Store	3.0	Gloves	3.5
Shoe Store	2.1	Dress Goods	3.2
Clothing Store	2.0	Silks	3.1
Jewelry Store	1.5	Carpets	1.5

The rate of turnover is found by dividing the average inventory of a year into the cost of goods sold during that year. Thus, if a grocer is to have a turnover of 10, as is shown in the preceding table, the cost of goods sold should be 10 times the average inventory.

The average inventory is found by adding the amount of each inventory taken during the year and by dividing that sum by the number of inventories. If an inventory is taken only at the beginning and the end of a year, the average is found by adding the two inventories and by dividing their sum by 2. If inventories are taken at the beginning of the year and at the end of each quarter, the five inventories are added and their sum is divided by 5. If inventories are taken at the beginning of the year and at the end of each month, the thirteen inventories are added and their sum is divided by 13. Obviously, the greater the number of inventories taken during the year, the more accurate will be the average.

The illustration given below shows the method of ascertaining the turnover when the beginning inventory is \$3,427.65; the ending inventory, \$3,116.65; and the net cost of the merchandise sold during the period, \$12,503.

$$\begin{array}{r}
 \$3,427.65 \\
 \$3,116.65 \\
 \hline
 2) \$6,544.30 \\
 \hline
 \$3,272.15 \\
 \$12,503 \div \$3,272.15 = \\
 3.82, \text{ or turnover}
 \end{array}$$

The beginning inventory, \$3,427.65, and the ending inventory, \$3,116.65, are added and divided by 2 to find the average inventory. The cost of the merchandise sold, \$12,503, is divided by the average inventory to find the turnover, 3.82, or the number of times the merchandise bought by this merchant was turned over during the business year represented.

The following problems provide practice in ascertaining turnover. You are to show all the calculations necessary to arrive at the turnover required. When the cost of the merchandise sold must be ascertained, show your calculations.

1. The cost of the merchandise sold by Northcutt & Bennett was \$21,678.48, and the average inventory was \$5,426.54. What was the rate of turnover?

2. The inventory of the Cash Grocery Company at the beginning of a certain year was \$16,400. At the end of the same year, the inventory was \$15,280. The cost of the sales for the year was \$152,856. What was the rate of turnover?

3. The inventories of the Lippincott Company at the beginning of a year and at the end of each quarter were as follows: \$1,762.92; \$1,837.34; \$1,854.44; \$2,005.18; and \$1,762.86. The cost of the merchandise sold during the year was \$18,965.48.

What was the rate of turnover, expressed as a mixed number with the decimal fraction in hundredths?

4. The inventories of the Jones Grocery Company at the beginning of the year and at the end of each month during the year were as follows: \$6,548.28; \$6,039.50; \$5,964.10; \$5,791.50; \$5,500.72; \$5,371.50; \$4,476.84; \$4,365.62; \$5,134.50; \$5,496.40; \$5,690.37; \$5,806.42; and \$5,941.89. The cost of the merchandise sold during the year was \$48,261.75. (a) What was the turnover? (b) How much more or less was this than the turnover for grocery companies given in the table on page 263?

5. The following information appeared on the books of the A. B. C. Company at the end of one business year:

Inventory of merchandise on hand at beginning of the year.....	\$ 7,962.75
Purchases during the year.....	21,648.55
Freight on merchandise purchased.....	892.94
Returned purchases.....	572.36
Inventory of merchandise on hand at end of the year.....	8,721.65

What was the rate of turnover?

NOTE: The net cost of merchandise purchased is the invoice cost, plus the freight, less the returns.

6. The cost of the goods sold by the A. B. Campbell Company during one year was \$89,462.75, and the rate of turnover was 7.87. What was the average inventory?

7. The beginning inventory of the Bingham-Richards Company was \$10,211.56; the purchases were \$18,562.48; the freight was \$419.75; the returned purchases were \$275.54; and the ending inventory was \$9,981.64. What was the rate of turnover?

8. If the average inventory of Burkhardt Brothers, dealers in men's furnishings, is \$21,515.40, and the rate of turnover during one year was that shown in the table on page 263, what was the cost of the merchandise sold during the year?

9. The cost of the goods sold by the H. K. Van Horn Co. during one year was \$45,679.35, and the rate of turnover was 4.7. What was the average inventory?

10. At the beginning of the year and at the end of each quarter during the year the inventories of the Michil & Michil Co. were as follows: \$4,589.20, \$4,962.50, \$5,682.43, \$6,791.51, \$6,123.78. The cost of the merchandise sold during the year was \$25,780.73. (a) What was the turnover? (b) How much more or less was this than the turnover for drug stores given in the table on page 263?

EXERCISE No. 173, OPERATING EXPENSES

If a merchant is to make a profit, his selling price must be greater than the cost of the merchandise sold plus the operating expenses. The cost of merchandise sold was explained in Exercise No. 168. The operating cost may be divided into two general classes: *selling expenses* and *general expenses*. Selling expenses include salaries of the sales clerks, advertising, cost of maintaining a delivery department, etc.; general expenses include rent, office supplies, office salaries, etc. The excess of the *profit on sales* over the *expenses* is referred to as *net profit*.

The illustration below shows the method of ascertaining the net profit when the profit on sales and the operating expenses are known. The solution shows the method of arriving at the net profit when the profit on sales is \$16,432.60, and the expenses are: salaries of sales clerks, \$2,846; store supplies, \$151.50; advertising, \$350; rent, \$900; office supplies, \$42.50; office salaries, \$4,287.75; miscellaneous general expense, \$51.75. The profit on sales is shown first to facilitate subtraction.

Profit on Sales.....		\$16,432.60
Salaries of Sales Clerks.....	\$2,846.00	
Store Supplies.....	151.50	
Advertising.....	350.00	
Total Selling Expenses.....		\$3,347.50
Rent.....	\$ 900.00	
Office Supplies.....	42.50	
Office Salaries.....	4,287.75	
Miscellaneous General Expense....	51.75	
Total General Expenses.....		5,282.00
Expenses.....		8,629.50
Net Profit.....		7,803.10

The profit made by selling merchandise is entered at the right. The selling expenses are grouped and added. The general expenses are grouped and added, and the sum of these two kinds of expenses is subtracted from the profit on sales to obtain the net profit.

NOTE: If this illustration is placed below the one in Exercise No. 168, you will have the complete process of ascertaining the net profit. The illustrations then show all the facts necessary to obtain: (a) cost of the merchandise sold; (b) profit on sales; (c) expenses; and (d) net profit.

The following problems provide practice in ascertaining the net profit resulting from the operation of a business:

1. The profit on the sales of merchandise of Coppin's Store during a certain year was \$37,561.27. The selling expenses during the year were: clerks' salaries, \$7,516.40; store supplies, \$842.50; and advertising, \$1,004.68. The general expenses during the year were: rent, \$3,600; office salaries, \$5,800; office supplies, \$137.66. What was the net profit resulting from the operation of the business?

2. The profit made by selling merchandise by Clark & Sons Company during the current year was \$9,621.50. The selling expenses during the year were: clerks' salaries, \$2,250; store supplies, \$152.50; advertising, \$265.92. The general expenses during the year were: rent, \$1,000; office salaries, \$2,500; office supplies, \$52.65. What was the amount of the net profit?

3. The profit made by selling merchandise during a year by the Adair Mercantile Company was \$12,469.87. The selling expenses were: salaries of sales clerks, \$4,621.82; store supplies, \$419.74; advertising, \$507.36. The general expenses during the year were: rent, \$2,500; office salaries, \$5,500; office supplies, \$213.66. What was the amount of net profit or net loss resulting from the operation of the business during the year?

4. The profit made by the Produce Exchange during the current year was \$16,982.42. The expenses during the year were as follows: salaries of sales clerks, \$5,171.50; store supplies, \$367.53; advertising, \$950; rent, \$1,800; office salaries, \$3,850; office supplies, \$215.76. What was the net profit or the net loss resulting from the operation of the business during the year?

5. The profit made by the Shoe Lumber Company through its operations during one year was \$18,216.65. The expenses during the year were as follows: rent, \$3,000; salaries of sales clerks, \$6,250; advertising, \$1,275.67; office supplies, \$221.78; store supplies, \$563.48; office salaries, \$5,200. Classify these items and ascertain the net profit or the net loss resulting from the operation of the business.

6. The profit made by selling merchandise during a certain year by the Acme Photograph Company was \$6,281.88. The expenses were as follows: rent, \$1,200; advertising, \$350; salaries of clerks, \$900; office salaries, \$1,500; store supplies, \$176.50; office supplies, \$95.40. What was the net profit?

7. The profit made by the Frank Cranmer Co. during one year was \$9,108.50. The expenses during the year were as follows: rent, \$1,500; salaries of sales clerks, \$3,500; advertising, \$738.50; office supplies, \$138.24; store supplies, \$289.42; office salaries, \$2,600. Classify these items and ascertain the net profit or the net loss resulting from the operation of the business.

8. The profit made by selling merchandise during a certain year by the Gannon & Gannon Co. was \$20,137.92. The expenses during the year were as follows: rent, \$3,300; salaries of sales clerks, \$6,225; advertising, \$1,350.45; office supplies, \$215.78; store supplies, \$578.41; office salaries, \$5,675. Classify these items and ascertain the net profit or the net loss resulting from the operation of the business.

**EXERCISE No. 174, RATE PER CENT OF PROFIT AND OF
EACH COST, BASED ON SALES**

For the purpose of making comparisons, expenses and profits are usually reduced to a percentage of sales. Some other basis might be used, but sales are a commonly desired basis since the total income of a business is frequently represented by the income from sales, and this income is divided among the cost of goods sold, the selling expenses, and the profit.

In each of the following problems find the percentage of sales represented by (a) the cost of sales, (b) the selling expenses, (c) the general expenses, (d) the net profit or the net loss.

	Sales	Cost of Sales	Selling Expenses	General Expenses
1.	\$ 8,435.99 ...	\$ 4,281.35 ...	\$ 1,987.40 ...	\$ 1,546.82
2.	169,784.31 ...	78,361.45 ...	31,079.65 ...	25,371.62
3.	48,378.53 ...	26,164.75 ...	9,163.57 ...	7,145.29
4.	274,684.92 ...	117,341.83 ...	46,780.34 ...	39,154.72
5.	8,884.65 ...	3,452.75 ...	1,583.32 ...	1,480.56
6.	27,475.93 ...	10,734.48 ...	4,896.57 ...	3,475.68
7.	834,751.28 ...	517,375.82 ...	98,108.41 ...	91,473.28
8.	514,928.94 ...	227,431.82 ...	85,821.56 ...	82,345.81
9.	137,350.21 ...	78,689.45 ...	33,498.34 ...	29,536.78
10.	16,534.95 ...	8,392.67 ...	2,479.37 ...	2,150.79
11.	114,763.95 ...	70,482.30 ...	20,496.27 ...	10,105.41
12.	90,646.08 ...	59,830.72 ...	20,394.60 ...	15,957.05

EXERCISE No. 175, ASCERTAINING THE SELLING PRICE

A merchant should know the cost of doing business. This cost includes rent, heat, light, sales clerks' salaries, delivery cost, advertising, etc. Knowing these costs and the invoice cost of the merchandise, he can determine the selling price which will enable him to obtain a profit. The table on page 271 shows the required selling price when the rate per cent of the cost of doing business and the desired per cent of profit are known. The cost of the article in the table is \$1, but this can be applied to a cost which is greater or less. The illustration below shows the method of applying the table.

The invoice cost of gloves is \$5.64 a dozen, and the freight is 12c a dozen. This means that the total cost of each pair of gloves is 48c. To ascertain the price at which the gloves are to be sold to make the desired profit, it is necessary to multiply .48 by the amount opposite the given rate per cent of the cost of doing business and under the given rate per cent of profit. Thus, if the cost of doing business is 23% of the net sales, and a 25% profit on sales is desired, multiply by 1.92: $.48 \times 1.92 = .9216 = 92c$, the retail price of the gloves.

In each of the following problems the cost of each item and the estimated percentage of profit represented by the expenses and the desired profit are given. Find the selling price of each item. Base your calculations upon the table given on page 271.

1				2			
	Cost	Expenses	Profit		Cost	Expenses	Profit
a. \$	0.89	21%	15%	a. \$	3.50	20%	25%
b.	1.75	25%	20%	b.	3.50	25%	40%
c.	.39	19%	12%	c.	.20	25%	20%
d.	.15	25%	25%	d.	.785	23%	25%
e.	.16	23%	20%	e.	18.65	22%	20%
f.	.29	24%	30%	f.	.35	15%	15%
g.	124.35	25%	35%	g.	.4825	18%	25%
h.	.09	24%	40%	h.	416.75	25%	15%
i.	1.14	22%	20%	i.	.375	21%	20%
j.	.35	25%	25%	j.	2.1425	23%	25%
k.	.48	18%	9%	k.	.65	18%	6%
l.	1.40	21%	8%	l.	2.50	22%	9%
m.	.16	15%	15%	m.	.37	17%	12%
n.	1.25	16%	9%	n.	.99	16%	6%
o.	.85	15%	7%	o.	.88	19%	8%

EXERCISE No. 176, MARKING GOODS

Sometimes a merchant may wish to mark on the tag attached to an article both the selling price and the cost price. The cost price may be needed when inventories are taken and when prices are reduced for special sales.

Since a merchant does not wish a customer to know the cost price of an article, this price, if given, is usually written in a code which can be interpreted only by those familiar with its meaning.

The illustration below shows the method of using the code word *pay-me-quick* with the letter *s* used as a repeater.

1 2 3 4 5 6 7 8 9 0
p a y m e q u i c k

Cost....\$7.19 Marking, upc
Cost.... 4.43 Marking, msy
Cost.... .99 Marking, cs

Referring to the application of this code word at the left, you will observe that the letters are substituted in place of figures, and that *s* is used as a repeater. This repeater is used only when two figures which are the same occur adjacent to each other, as the two 4's in 443.

Any word, or group of words, containing ten letters, no two of which are the same, can be used as a code word. Either small letters or capitals may be used when the cost of an article is marked.

A Table Showing Price at Which You Must Sell an Article Costing \$1.00 In Order to Make Any Desired Net Profit

15 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.19	1.21	1.22	1.24	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.54	1.67	1.82	2.00	2.22	2.86
	Sell for.....																					
16 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.21	1.22	1.24	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.56	1.70	1.85	2.04	2.27	2.94
	Sell for.....																					
17 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.22	1.24	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.59	1.72	1.89	2.08	2.33	3.03
	Sell for.....																					
18 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.24	1.25	1.27	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.61	1.75	1.92	2.13	2.38	3.13
	Sell for.....																					
19 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.64	1.79	1.96	2.17	2.44	3.23
	Sell for.....																					
20 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.67	1.82	2.00	2.22	2.50	3.33
	Sell for.....																					
21 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.70	1.85	2.04	2.27	2.94	3.45
	Sell for.....																					
22 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.59	1.72	1.89	2.08	2.33	3.03	3.57
	Sell for.....																					
23 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.59	1.61	1.75	1.92	2.13	2.38	3.13	3.70
	Sell for.....																					
24 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.59	1.61	1.64	1.79	1.96	2.17	2.44	3.23	3.85
	Sell for.....																					
25 %	Cost of Doing Business	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Net Profit.....	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.59	1.61	1.64	1.67	1.82	2.00	2.22	2.50	3.33	4.00
	Sell for.....																					

These figures are computed on a basis of SALES. They are taken from Butler Brothers Way System Book.

The following code words are suggested for use in marking the cost price of merchandise. Characters can be used, but code words are better.

- | | | |
|-------------------|----------------|----------------|
| 1. Cornbasket | 3. Victor Mead | 5. Alice Thumb |
| 2. M. H. Lockyear | 4. Cedar Point | 6. Paymequick |

The following problems provide practice in (a) ascertaining the selling price of goods and (b) marking this selling price on the article. The six code words given above are to be used.

1. The Fair Store has six departments. The cost and the selling price are marked on each article, but a different code word is used for each department. The following table shows one or more articles sold in each department and gives the cost and the selling price of each. You are to copy this table and to insert the desired information in the columns that are blank. The last column at the right gives the number of the code word to be used. Use x as a repeater.

KIND OF GOODS	UNIT	COST	CODE	SELLING PRICE	CODE	CODE No.
a. Radium silk	yard	\$ 1.25		\$ 1.70		1
b. Men's shoes	pair	10.75		12.80		3
c. Men's hats	each	3.25		5.00		4
d. Armchairs	each	25.60		32.80		5
e. Men's suits	each	32.50		45.00		3
f. Ladies' hose	pair	1.45		2.25		6
g. Ladies' shoes	pair	8.30		10.40		6
h. Taffeta	yard	1.75		2.35		1
i. Satin	yard	2.50		2.89		1
j. Ladies' purses	each	5.40		8.25		2

2. The Peoples Grocery Company bought 150 bushels of potatoes at \$1.75 a bushel and paid \$22.50 for freight and \$7.50 for drayage. The company wishes to sell them at a price which will include a 20% profit and which will allow an additional 10% of sales to provide for the selling expense. You are to show: (a) the cost price of a bushel, expressed by code word No. 3; and (b) the selling price of a bushel, expressed by the same code word.

3. I bought 40 dozen straw hats at \$36.40 a dozen, less 10%, 5%, and 2%. I paid freight amounting to \$19.10. How shall I mark them, using code word No. 2, if I want to gain $33\frac{1}{3}\%$ on sales and to allow 10% of sales for the expense of selling?

4. Goods marked $\frac{yek}{mun}$ by the use of code word No. 6 are sold at what per cent of profit on (a) cost, and (b) sales, if $12\frac{1}{2}\%$ of the sales is for selling expense?

5. Using code word No. 6, show the new price of the goods in Problem 4 if 20% will be realized on sales and 5% of sales will be allowed for expense.

6. John Hammond bought 320 hammers at \$16.20 a dozen, less trade discounts of 5%, $2\frac{1}{2}\%$, and 1%. By paying cash, he received a further discount of 2%. If the freight was \$7.80, how did he mark each hammer by using code word No. 1 if he made a profit of 5% on cost and allowed 10 cents on each hammer for selling expense?

7. A ream of paper (500 sheets) costs \$1.20. How many sheets can I sell for a nickel and gain 20% on sales, allowing 5% of sales for the expense of selling?

8. Harry Ritter bought 5,000 cigars at \$45 a thousand and received 250 cigars extra as a discount. (a) At what price must he sell them to make a profit of 20% on sales and to allow 5% of sales for expenses? (b) Using code word No. 4, show the marks he will place on a box containing 50 cigars. (c) How many cigars can he afford to sell for 35c?

9. C. H. Douglas purchased 1,780 pounds of ham at 27c a pound. He knew by experience that the weight would be reduced 5% through shrinkage and the variation of weight in selling. At what price a pound was this ham sold if Douglas gained 20% on sales and allowed 10% of sales for selling expense?

10. The Novelty Shop bought one hundred dolls at \$21.84 a dozen. Each was marked at a cost price of *meh* and a selling price of *hkr* (code word No. 2). When fifty-nine dolls had been sold, the selling price was increased so that the sale of the remainder would make good a loss because of one having been broken. You are to show: (a) the calculations necessary to arrive at the new selling price, and (b) the marking to show the new selling price in the same code

CHAPTER 54

PROBLEMS OF A MANUFACTURER

A manufacturer buys raw material and through the manufacturing process changes it in form to meet the requirements of his customers. The cost of the merchandise he manufactures includes (a) the raw material, (b) the transportation cost on the raw material, (c) the labor required in the manufacture, and (d) the manufacturing expenses, such as rent, heat, light, superintendent's salary, foreman's salary, etc.

EXERCISE No. 177, COST OF GOODS MANUFACTURED

A manufacturer records the raw material in stock at the beginning of the year, the raw material purchased during the year, the freight on this raw material, the wages paid employees, and the manufacturing expenses. From these facts and the inventory at the end of the year, he can ascertain the cost of the goods manufactured.

The records of the Bryant Manufacturing Company show the following facts: raw material on hand at the beginning of the year, \$8,261.50; raw material purchased during the year, \$9,965.60; freight on raw material, \$865.55; labor, \$6,542.90, manufacturing expense, \$4,407.60; raw material on hand at the end of the year, \$7,986.42. The method of arriving at the cost of the goods manufactured is shown in the illustration below.

Beginning Inventory of Raw Material.....		\$ 8,261 .50
Purchases of Raw Material.....	\$9,965 .60	
Freight on Raw Material.....	865 .55	10,831 .15
Total Raw Material Available.....		19,092 .65
Less Ending Inventory of Raw Material.....		7,986 .42
Cost of Raw Material in Goods Manufactured..		11,106 .23
Labor.....	6,542 .90	
Manufacturing Expense.....	4,407 .60	10,950 .50
Total Cost of Goods Manufactured.....		\$22,056 .73

The cost of the raw material on hand at the beginning of the year, plus the cost of the raw material purchased during the year, plus the freight,

gives the total cost of raw material to be accounted for. Deducting the value of the raw material in stock at the end of the year gives the amount of raw material used in the goods manufactured. Adding to this the labor cost and the manufacturing expense gives the total cost of the manufactured goods.

The following problems provide practice in ascertaining the cost of goods manufactured. Show the solution of each problem arranged in the same form as that in the illustration.

1. Beginning inventory, \$8,729.65; purchases, \$12,500.00; freight on purchases, \$1,162.41; ending inventory, \$4,861.55; labor, \$8,123.40; manufacturing expense, \$3,641.82.

2. Beginning inventory, \$9,779.32; purchases, \$13,641.50; freight on purchases, \$892.99; ending inventory, \$6,267.68; labor, \$9,175.55; manufacturing expense, \$6,237.80.

3. Beginning inventory, \$9,465.50; ending inventory, \$7,622.50; purchases, \$15,582.50; freight, \$2,004.17; labor, \$11,621.92; manufacturing expense, \$9,471.75.

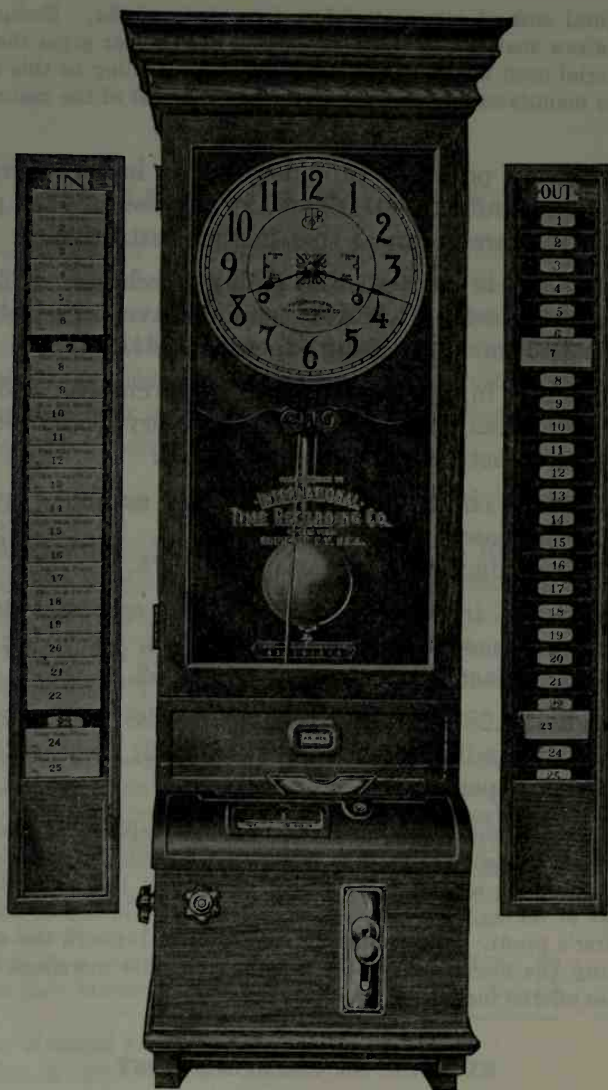
4. Beginning inventory, \$10,999.87; ending inventory, \$8,642.55; purchases, \$16,687.96; freight, \$762.55; labor, \$5,421.75; manufacturing expense, \$1,232.52.

5. Freight, \$4,281.17; purchases, \$22,694.98; beginning inventory, \$7,655.55; ending inventory, \$10,217.62; labor, \$12,552.48; manufacturing expense, \$7,216.66.

NOTE: The manufacturer makes a profit by selling the merchandise he produces at a greater price than it costs to manufacture. The amount added to the cost to ascertain the selling price must be sufficient to cover (a) the cost of selling, (b) the cost of maintaining the office, and (c) the manufacturer's profit. The manufacturer produces through the operations of his factory the merchandise he offers for sale; the merchant buys the merchandise offered for sale.

EXERCISE No. 178, LABOR COST

One of the chief problems of the manufacturer is to ascertain the labor cost of the merchandise manufactured. To facilitate the calculations, it is customary to require each employee to keep a record of his own time through the use of a time clock. The illustration on page 276 shows a time clock, and that on page 277, the record of an employee's time made by registering his time on the card through the use of the time clock. With the num-



TIME CLOCK

Each employee is provided with a number and with a card on which to keep a record of his time for each week. This record is made on the time clock, which records the time automatically when the card is placed in the clock and the lever below the clock is depressed. The rack at the left contains the cards while the employees are at work, and the rack at the right contains these same cards when the employees are not at work.

ber of hours worked by the employee available, the time clerk can ascertain the amount due the employee by multiplying the number of hours by the wage paid for an hour's work.

No. <u>24</u>							
<u>Albert Barnes</u>							
WEEK ENDING <u>April 10, 1926</u>							
DAY	MORNING		AFTERNOON		OVERTIME		
	IN	OUT	IN	OUT	IN	OUT	
SUN							
MON	7:30	12:00	12:50	5:03			8½
TUE			12:55	5:01			4
WED	7:25	12:05	12:54	5:01			8½
THU	9:15	12:01	12:50	5:04			6½
FRI	7:28	12:00	12:59	5:05	5:30	7:36	11½
SAT	7:29	1:05					5½
TOTAL TIME <u>44½</u> HRS.							
RATE <u>60</u>							
TOTAL WAGES FOR WEEK <u>\$26.85</u>							

Each employee is given a time card which contains his name, his number, the date and the space for the time during which he works each day of the week. In the illustration, Albert Barnes, employee No. 24, worked full time on Monday because he registered before beginning time in the morning (7:30), after quitting time at noon (12:00), before beginning time in the afternoon (1:00), and after quitting time in the afternoon (5:00). On Tuesday Mr. Barnes did not work in the forenoon; hence, he will receive pay for only 4 hours. On Wednesday he worked full time. On Thursday he was one and three fourths hours late; hence, he worked only 6½ hours. On Friday he worked two hours over time. It was the custom of this company to pay for over time at the rate of time

and one-half; that is, for the two hours over time, Mr. Barnes would receive credit for having done three hours' work. This makes the total for Friday 11½ hours. On Saturday he worked the usual time, from 7:30 until 1:00, or 5½ hours.

The total number of hours worked during the week is 44½. The rate an hour is 60c; hence, Mr. Barnes will receive $.60 \times 44\frac{1}{2}$, or \$26.85. Sometimes the information on the card is transferred to a sheet similar to that shown on page 279 and the amount due is recorded on this sheet instead of the card. In other words, the pay roll may be made up directly from the information recorded on the cards or from a pay roll sheet, to which this information has been transferred.

The following problems provide practice in ascertaining the time entered on the time cards on page 278 and the amount due each employee. The daily working hours applicable to each of the four time cards shown in Problems 1-4 on page 278 are 7:30 a.m. to 12 m. and 12:30 p.m. to 4:30 p.m. for the first five days, and 7:30 a.m. to 1:00 p.m. for Saturday. Any time worked before or after these hours is overtime, which is paid for at an agreed rate of time and a half; this means that the employee who works 1 hour overtime is paid for 1½ hours. You are to ascertain from

each time ticket: (a) the total regular time and overtime for the week, and (b) the amount of the employee's wages for the week at the rate given.

1.

No. 1

L. B. Smith

WEEK ENDING, May 15, 19__

DAY	MORNING		AFTERNOON		OVERTIME	
	IN	OUT	IN	OUT	IN	OUT
FRI.	7:28	12:01	12:29	4:32		
SAT.	7:00			1:03		
SUN.						
MON.	7:27	12:01	12:28	4:32		
TUE.	7:29	12:02	12:29	4:31		
WED.			12:28	4:30	4:31	7:00
THU.	7:28	12:01	12:29	4:31		
TOTAL TIME					HRS.	
RATE					\$.65	
TOTAL WAGES FOR WEEK \$						

2.

No. 2

Frank Day

WEEK ENDING, May 15, 19__

DAY	MORNING		AFTERNOON		OVERTIME	
	IN	OUT	IN	OUT	IN	OUT
FRI.	7:29	12:02	12:29	4:31		
SAT.	8:00			1:01		
SUN.						
MON.	7:29	12:02	12:29	4:32		
TUE.	6:30	12:01	12:28	4:31		
WED.	7:28	12:01				
THU.			12:29	4:30	4:31	6:30
TOTAL TIME					HRS.	
RATE					\$ 1.00	
TOTAL WAGES FOR WEEK \$						

3.

No. 3

George Martin

WEEK ENDING, May 15, 19__

DAY	MORNING		AFTERNOON		OVERTIME	
	IN	OUT	IN	OUT	IN	OUT
FRI.	7:28	12:01	12:29	4:31		
SAT.	7:29			1:02		
SUN.						
MON.			12:29	4:30	4:31	6:30
TUE.	7:29	12:02	12:28	4:32		
WED.	7:29	12:01	12:29	4:31		
THU.	7:28	12:01	12:28	4:30	4:31	7:30
TOTAL TIME					HRS.	
RATE					\$ 1.25	
TOTAL WAGES FOR WEEK \$						

4.

No. 4

J. D. Kline

WEEK ENDING, May 15, 19__

DAY	MORNING		AFTERNOON		OVERTIME	
	IN	OUT	IN	OUT	IN	OUT
FRI.	9:00	12:02	12:29	4:30	4:31	6:00
SAT.	7:29			1:02		
SUN.						
MON.			12:29	4:30	4:31	6:30
TUE.	7:28	12:01	12:28	4:31		
WED.	6:30	12:02	12:29	4:32		
THU.	7:29	12:01	12:28	4:31		
TOTAL TIME					HRS.	
RATE					.95	
TOTAL WAGES FOR WEEK \$						

5.

PAY ROLL AND MEMORANDUM

No.	NAME	HOURS PER DAY						TOTAL HOURS	WAGES PER HOUR	TOTAL WAGES	BILL AND SPECIAL MEMORANDUM									
		M	T	W	T	F	S				\$10	\$5	\$2	\$1	50c	25c	10c	5c	1	
1	L. Scott.....	8	8	8	8	8	4	44	.95	41 80	4			1	1	1		1		
2	T. Buchanan.....	8	8	8	8	8	5	45½	.89	40 50	4				1					
3	R. B. Brown.....	8	4	7½	8	6	4	38½	.81	30 38	3					1	1		3	
4	E. B. Wickman.....	7	8	8	7	8	4	42	.86	36 22	3	1		2			1		2	
5	R. Curry.....	8	7	4	8	6½	4	37½	.87	32 63	3		1		1		1		3	
6	J. W. O'Dell.....	8	8	7	7	8	4	42	.85	35 70	3	1			1		2			
7	B. L. Hughes.....	4	8	8	8	7	4	39	.90	35 10	3	1					1			
8	H. P. Roberts.....	8	8	8	8	8	4	44	.92	40 48	4					1	2		3	
9	P. G. Hudson.....	8	8	8	8	8	4	44	.83½	36 57	3	1		1	1		1	1	2	
10	J. Bridges.....	8	8	7	8	8	4	43	.90	38 70	3	1	1	1	1		2			
11	A. Hickling.....	8	8	6	7	7	4	40	.91	36 40	3	1		1		1	2	1		
12	Mack Hind.....	8	7	8	6	8	4	42	.87½	35 88	3	1			1	1	1		3	
13	T. Romano.....	8	8	8	8	7	5½	45½	.89	40 27	4					1			2	
14	T. W. Quandt.....	8	5½	8	7	7½	4	40	.91	36 45	3	1		1		1	1	1		
								Totals												

This pay roll sheet was made up from daily time cards similar to those in the preceding problems. Full time is 8 hours each day for the first five days and 4 hours for Saturday. Time and one-half is allowed for overtime. You are to verify: (a) the amount of each employee's wages and (b) the change required to pay each employee, and are to ascertain: (c) the total pay roll. The method of ascertaining the correct change was explained and illustrated on page 20.

6. The data given in the form at the top of page 280 applies to piece work. Each employee receives 37c a unit or piece which he or she completes. The amount due each employee is ascertained by adding the number of units he has completed during the 6 days and multiplying the sum by the amount paid for a unit. When

different amounts are paid for different units, it is necessary to have a separate column in which to record the number of units applicable to each price.

No.	NAME	M.	T.	W.	Th.	F.	S.
136	A. L. Day.....	9	11	14	12	10	5
137	C. H. Gay.....	8	9	11	13	11	5
138	R. H. Joy.....	10	11	13	14	12	5
139	O. B. Good.....	11	10	12	14	10	7
140	Geo. Mays.....	12	12	12	10	11	5
141	John Martin.....	11	11	11	11	11	5
142	Caleb Powers.....	12	11	13	12	10	5
143	R. H. Aul.....	12	11	13	12	10	5

Copy the information obtained from this form on a pay roll sheet similar to that in Problem 5. Ascertain: (a) the amount due each employee for the number of pieces completed during the week, (b) the total amount due the employees, (c) the change necessary to pay each employee; and show (d) the proof of the change.

7.

WEEKLY PAY ROLL SHEET

No.	NAME	M.	T.	W.	Th.	F.	S.	RATE
1	Alice Stone.....	8½	9	9	9½	8½	5½	\$0.42½
2	Alice Bateman.....	9¾	9	8	..	..	..	.37½
3	Martha Wright.....	9	9½	8	8	8½	5½	.40
4	Nora Kirk.....	9	8½	7	8	7	5½	.28
5	Etta Brown.....	9	10	9	..	9	5½	.33½
6	Lucy Maurer.....	7	7	7	7	7	7	.40
7	Mabel Davis.....	8½	8½	8½	8½	8½	5½	.50
8	Alice Pringle.....	8½	8½	8½	8½	8½	5½	.50
9	Hazel Howard.....	7¼	8½	8½	8½	8½	..	.46¾
10	Viva Baker.....	8½	..	3½	8½	8½	5½	.50
11	Mary Wheaton.....	8½	8½	9	8½	8½	5½	.45
12	Rose Lee.....	8½	8½	9	8½	7½	5½	.48

The regular time is 48 hours a week: 8½ hours on each of the first five days of the week and 5½ hours on Saturday. Time in excess of the regular time for each day is overtime, to be paid on a basis of time and one-half. Find: (a) the amount due each employee, (b) the total amount of the pay roll, and (c) the change necessary to pay each employee.

8.

WEEKLY PAY ROLL SHEET

No.	NAME	M.	T.	W.	Th.	F.	S.	RATE
1	Roland Ward.....	8	9	9	10½	9½	5	\$0.94
2	Dick Rowan.....	9¾	9½	8	8	9½	5	.52
3	Ben Putnam.....	8	8	..	9½	8	5	.45
4	Thos. Morgan.....	9	9	8	10	10	5	.47½
5	T. E. Castle.....	8	8	9	8	9	5	.50
6	W. R. Allen.....	10	8½	8	10	..	..	.55
7	Roy De Sort.....	9½	9½	8	9	9½	6	.48
8	Pat Hagan.....	..	..	..	9½	8	5	.43½
9	Chas. Titch.....	9	9	9	½	10	5	.43½
10	G. E. Davis.....	9	8	10	9	8	5	.66
11	T. M. Lee.....	8	9½	9	8	9½	7	.60

The regular working time is 45 hours a week: 8 hours on each of the first five days of the week and 5 hours on Saturday. Time in excess of the regular time for each day is overtime, to be paid on a basis of time and one-half. Find: (a) the amount due each employee, (b) the total amount of the pay roll, and (c) the change necessary to pay each employee.

9. The following shows the time and the wage rate of 14 employees of the Day Manufacturing Company. The regular working time is 8 hours on each of the first five days of the week and 5 hours on Saturday. Time in excess of the regular time is to be paid for at the rate of time and one-half. You are to ascertain: (a) the amount due each employee, (b) the total of the weekly pay roll, and (c) the change required to pay each employee.

No.	NAME	M	T	W	T	F	S	RATE	No.	NAME	M	T	W	T	F	S	RATE
1		8	8	8	4½	8	5	\$0.54½	8		7½	7½	8	8	8	5	\$0.57½
2		8	7½	8½	7½	7½	5	.57½	9		8	8	..	..	7½	5	.53½
3		5½	8	8	8	8	5	.57½	10		8½	8	8	..	4½	5	.47½
4		8	8	7½	..	..	5	.46½	11		8	8	8	8	8	5	.53½
5		..	8	8	8½	8½	5	.48	12		8	8	8	8	8	5	.48½
6		8	8½	7½	8½	8	5	.52½	13		8	7½	8	8	8	5	.57½
7		8½	8	8½	8½	8	5	.56	14		7½	7½	8½	8	7½	5	.57½

10. The Davis Contracting Company has 12 employees who earn hourly wages as follows:

No.	Name	Hourly Wage
1	A. L. Jones	95c
2	Frank Baker	95c
3	George Craft	95c
4	Harry Ritter	82c
5	Albert Brooks	82c
6	W. C. Luckey	82c
7	James Johnson	75c
8	C. A. Norman	75c
9	J. M. Farris	75c
10	C. B. Crawford	67c
11	James Walker	67c
12	George Bailey	67c

The number of hours worked by each employee during the week ending May 12 was as follows:

Monday: No. 1, $8\frac{1}{2}$ hours; No. 2, 8 hours; No. 3, $8\frac{1}{2}$ hours; No. 4, $8\frac{1}{2}$ hours; No. 5, 7 hours; No. 6, 8 hours; No. 7, 7 hours; No. 8, $8\frac{1}{2}$ hours; No. 9, 8 hours; No. 10, $8\frac{1}{2}$ hours; No. 11, 8 hours; No. 12, $8\frac{1}{2}$ hours.

Tuesday: No. 1, 8 hours; No. 2, $8\frac{1}{2}$ hours; No. 3, 7 hours; No. 4, $8\frac{1}{2}$ hours; No. 5, 8 hours; No. 6, 7 hours; No. 7, 8 hours; No. 8, 8 hours; No. 9, 7 hours; No. 10, $8\frac{1}{2}$ hours; No. 11, 7 hours; No. 12, 8 hours.

Wednesday: No. 1, 8 hours; No. 2, $8\frac{1}{2}$ hours; No. 3, $8\frac{1}{2}$ hours; No. 4, 7 hours; No. 5, $8\frac{1}{2}$ hours; No. 6, $8\frac{1}{2}$ hours; No. 7, $8\frac{1}{2}$ hours; No. 8, $8\frac{1}{2}$ hours; No. 9, 8 hours; No. 10, 8 hours; No. 11, 8 hours; No. 12, 7 hours.

Thursday: No. 1, $8\frac{1}{2}$ hours; No. 2, $8\frac{1}{2}$ hours; No. 3, $8\frac{1}{2}$ hours; No. 4, 8 hours; No. 5, 7 hours; No. 6, 8 hours; No. 7, 8 hours; No. 8, 8 hours; No. 9, $8\frac{1}{2}$ hours; No. 10, 8 hours; No. 11, $8\frac{1}{2}$ hours; No. 12, $8\frac{1}{2}$ hours.

Friday: No. 1, 8 hours; No. 2, $8\frac{1}{2}$ hours; No. 3, 7 hours; No. 4, $8\frac{1}{2}$ hours; No. 5, $8\frac{1}{2}$ hours; No. 6, $8\frac{1}{2}$ hours; No. 7, $8\frac{1}{2}$ hours; No. 8, 8 hours; No. 9, 8 hours; No. 10, $8\frac{1}{2}$ hours; No. 11, $8\frac{1}{2}$ hours; No. 12, $8\frac{1}{2}$ hours.

Saturday: No. 1, 5 hours; No. 2, 5½ hours; No. 3, 4½ hours; No. 4, 5 hours; No. 5, 5½ hours; No. 6, 5½ hours; No. 7, 5 hours; No. 8, 5½ hours; No. 9, 5½ hours; No. 10, 5 hours; No. 11, 5 hours; No. 12, 5 hours.

The regular working time is 8 hours on each of the first five days of the week and 5 hours for Saturday. Time in excess of the regular time is to be paid for at the rate of time and one-half.

You are to ascertain: (a) the amount due each employee and (b) the change necessary to pay him.

11. The Jones Manufacturing Company operates on a piece basis with a differential rate. The rate is 14c a piece with a standard of forty pieces for each day. For each piece over the standard of forty pieces that an employee completes in one day, the rate per piece on all pieces is increased ¼c. For each piece under the standard completed during a day, the rate per piece on all pieces is decreased ¼c. This means that an employee who completes forty-five pieces will receive 15¼c for each of them; whereas an employee who completes only thirty-eight pieces will receive only 13½c for each of them.

The number of pieces completed by nine employees during one week is given in the illustration below. You are to show all calculations necessary to find the amount due each employee.

NAME	M.	T.	W.	Th.	F.	S.
Mary Brown.....	37	36	35	40	32	33
Sadie Brewer.....	42	45	39	36	40	40
Mabel Homer.....	42	42	41	40	39	40
Jessie Clark.....	41	41	39	37	..	36
Bessie Davis.....	42	42	42	40	39	41
Ruth Haynes.....	41	42	40	41	42	39
Flora Bennett.....	39	40	42	41	38	37
Lucy Wright.....	41	43	40	38	39	40
Laura Clark.....	38	39	41	37	40	38

EXERCISE No. 179, DISTRIBUTION OF RENT

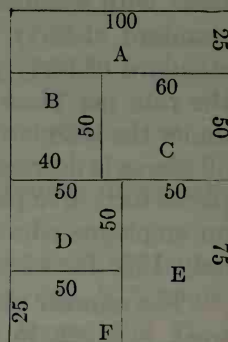
Manufacturing expense includes: (a) rent, (b) taxes, (c) insurance, (d) depreciation, (e) superintendent's salary, (f) foreman's salary, (g) heat, (h) light, (i) power, and (j) special services furnished employees, such as soap, water, towels, etc. Manufacturing expense is distributed over the cost of the goods manu-

factured by the various departments, or *factors*, as they are sometimes termed in the factory.

The rent cost is usually distributed over each department on a basis of the floor space occupied by the department. Thus, if a factory has five departments and each occupies the same floor space, the rent will be divided equally among them; but if one department occupies more floor space than another, this department will be charged with a greater part of the rent.

The illustration at the right is a diagram of a factory with six departments and shows the floor space occupied by each department. At the left of this is shown the method of distributing the monthly rent of \$300.

Dept. A of	2,500 sq. ft.	is $\frac{1}{6}$	or \$ 50.00
Dept. B of	2,000 sq. ft.	is $\frac{2}{5}$	or 40.00
Dept. C of	3,000 sq. ft.	is $\frac{1}{3}$	or 60.00
Dept. D of	2,500 sq. ft.	is $\frac{1}{6}$	or 50.00
Dept. E of	3,750 sq. ft.	is $\frac{1}{4}$	or 75.00
Dept. F of	1,250 sq. ft.	is $\frac{1}{12}$	or 25.00
Proof	15,000 sq. ft.	is $\frac{60}{60}$	or 300.00



Since the factory occupies 15,000 square feet, the part of the \$300 charge against any department will be the result obtained by multiplying \$300 by a fraction which has the total square feet in the factory as the denominator and the number of square feet in the department as the numerator. When the rent is paid, each department is charged with the amount in the right-hand column on a line with it. This process insures the rent cost being included in the costs applicable to operating the department, and being used as a basis in arriving at the net profit resulting from the operation of the department.

The following problems provide practice in distributing rent. Show all the calculations necessary to distribute the rent.

- The Thompson Manufacturing Company occupies two floors of a building, 200 ft. by 200 ft., inside measurements. The operations are grouped in seven departments. Department A occupies the entire first floor. The second floor contains the other six departments. The space for each is shown in the diagram at the left. The rent is \$12,000 a year. You are to ascertain the amount of the monthly rent to be charged against each department.

50	125	75	100
	B		
60	C	D	50
	125	75	
40	125	E	50
		F	
	G	200	50

2. The Davidson Garage occupies one floor of a building, 75 ft. by 195 ft. for which it pays an annual rent of \$9,000. The concern maintains four departments: (a) storage, (b) repairs, (c) paint shop, and (d) used car stock. The storage department occupies 50 ft. by 100 ft.; the repair shop, 95 ft. by 45 ft.; the paint shop, 25 ft. by 100 ft.; used car department, 30 ft. by 95 ft. You are to determine the amount of the monthly rent to be charged to each department.

3. The Newman Printing Company occupies the entire fourth floor of a building with 7,000 sq. ft., for which it pays an annual rent of \$4,800. Ascertain the proper distribution of the monthly rent over the following departments: office, 600 sq. ft.; composing room, 1,200 sq. ft.; pressroom, 1,800 sq. ft.; bindery, 2,500 sq. ft.; storeroom, 900 sq. ft.

4. The Fair Store occupies a three-story building 60 ft. by 120 ft. for which it pays a yearly rental of \$15,000. It maintains six departments, designated as A, B, C, D, E, and F. Department A occupies 60 ft. by 80 ft. on the first floor; Department B, the remainder of this floor; Department C, 30 ft. by 60 ft. on the second floor; Department D, the remainder of the second floor; Department E, 60 ft. by 90 ft. on the third floor; and Department F, the remainder of this floor. You are to ascertain the proper distribution of the monthly rent over these six departments.

NOTE: Many of the problems of the manufacturer are also the problems of the merchant, especially those relating to the proper allocation of operating costs to the different departments.

5. The Day Machine Shop occupies two floors of a building 190 ft. by 200 ft. for which it pays an annual rent of \$7,500. You are to allocate the monthly rent over six departments, designated as Nos. 1, 2, 3, 4, 5, and 6. Department No. 1 occupies $\frac{3}{4}$ of the first floor; Department No. 2, $\frac{2}{5}$ of the remainder; and Department No. 3, the remainder of the first floor. Department No. 4 occupies $\frac{1}{4}$ of the second floor; Department No. 5, $\frac{2}{5}$ of the second floor, and Department No. 6, the remainder.

EXERCISE No. 180, DISTRIBUTION OF TAXES AND DEPRECIATION

In a manufacturing business it is necessary to have machines. The owner will be required to pay personal property tax on the

value of this property. This tax is one of his operating expenses; hence, it should be distributed over all departments on a basis of the property valuation in the department. To make this distribution, it is necessary to multiply the total amount paid for taxes by a fraction, of which the total value of all the property of the departments is the denominator and the value of the property in the particular department is the numerator.

The machinery used in each department will depreciate because of wear. Depreciation is also a charge against the department. The amount of this charge is ascertained by taking a certain per cent of the cost value of the machinery. Each department is charged with the depreciation of the property used in the department.

In each of the following problems you are to find: (a) the cost of the taxes for each department, the distribution being made on the basis of hundred-dollar units; and (b) the depreciation of the machinery of each department.

1. The Mason Manufacturing Company has four manufacturing departments and an office, designated as departments A, B, C, D, and O. The cost value of the property in each department is as follows: Department A, \$12,986.42; Department B, \$21,487.36; Department C, \$9,017.55; Department D, \$18,513.44; Department O, \$4,225.90. The amount of taxes paid during a certain year was \$2,165.90, and the rate of depreciation for each department was 15%.

When the hundred-dollar-unit basis is applied, the value of the property in Department A is stated as \$13,000; that in Department B, as \$21,500; that in Department C, as \$9,000; that in Department D, as \$18,500, and that in Department O, as \$4,200.

2. The value of the property in the seven departments of the Thompson Manufacturing Company, mentioned in Problem 1 of the preceding exercise, is as follows: Department A, \$18,500; Department B, \$12,500; Department C, \$22,500; Department D, \$25,400; Department E, \$1,740; Department F, \$1,255; Department G, \$2,500. The taxes paid by this company are based on a rate of \$28.50 a thousand. The depreciation applicable to the machinery in each department is: A, $12\frac{1}{2}\%$; B, 15%; C, 10%; D, 13%; E, 15%; F, $12\frac{1}{2}\%$; and G, 20%.

3. The total value of the property in the four departments of the Davidson Garage, referred to in Problem 2 of Exercise No.

179, is \$9,960. $\frac{1}{3}$ of this property is in Department A, $\frac{1}{4}$ of the remainder, in Department B; $\frac{1}{2}$ of the remainder in Department C; and the remainder, in Department D. The taxes paid during one year were \$987.65, and the rate of depreciation for each department was 15%.

4. The Newman Printing Company, mentioned in Problem 3, Exercise No. 179, paid \$1,246.85 taxes during a certain year and depreciated the property in each department at 20%. The valuation of the property in the office is \$2,000; in the composing room, \$5,800; in the pressroom, \$14,500; in the bindery, \$6,750; in the storeroom, \$500.

5. The value of the property in the six departments of the Day Machine Shop, mentioned in Problem 5, Exercise No. 179, is as follows: No. 1, \$22,500; No. 2, \$5,480; No. 3, \$1,250; No. 4, \$4,465; No. 5, \$9,800; No. 6, \$1,248. The depreciation applicable in each department is: No. 1, 15%; No. 2, $12\frac{1}{2}\%$; No. 3, 15%; No. 4, 20%; No. 5, 18%; No. 6, 16%. The taxes paid during one year were \$1,004.78.

EXERCISE No. 181, DISTRIBUTION OF SUPERINTENDENT'S SALARY

The superintendent's salary is usually distributed on a basis of the number of productive machine hours of each department. The method of distribution is the same as that of distributing rent, except that the total machine hours are used as the denominator of the fraction and the number of hours of production in each department is used as the numerator.

Machine hours refers to the number of hours during which a machine or group of machines of the same size is used without reference to the number of men required to operate the machine or the group of machines.

The following problems provide practice in distributing a superintendent's salary on the productive machine-hour basis:

1. The superintendent of the Newman Printing Company receives a salary of \$6,300 a year. This salary is distributed over the various departments on a basis of the actual number of productive machine hours. For the month of September the production was as follows: composing room, 1,530 hours; pressroom, 1,240 hours; bindery, 1,350 hours; storeroom, 250 hours. Show the allocation of the superintendent's salary for the month of September.

2. The superintendent of the Thompson Manufacturing Company receives a salary of \$5,580 a year. Only five of the seven departments are producing centers and are under the supervision of the superintendent. For April Department A produces 11,425 hours; Department B, 6,780 hours; Department C, 8,975 hours; Department E, 7,500 hours; Department G, 2,520 hours. You are to show the proper allocation of the monthly salary of the superintendent, based on the actual number of hours.

3. The salary of the superintendent of the Davidson Garage is \$4,800 a year. This is to be allocated to the four departments according to the number of employees in each department. Department A has 5 employees; Department B, 12; Department C, 10; Department D, 5. Show the allocation of the salary of the superintendent for the month of June, based on the actual number of employees.

4. The Robbins Machine Tool Company pays its superintendent \$13,500 a year. This salary is allocated monthly to the five different departments. During a certain month Department A produced 18,000 hours; Department B, 16,716 hours; Department C, 9,421 hours; Department D, 10,016 hours; and Department E, 8,412 hours. The distribution is to be made on a 100-hour-unit basis. You are to ascertain the allocation of the superintendent's salary for that month to the five different departments.

5. The superintendent of the Day Machine Shop receives a salary of \$7,560 a year. This salary is distributed on a basis of the actual number of employees in each department as follows: No. 1, 75; No. 2, 40; No. 3, 15; No. 4, 25; No. 5, 12; No. 6, 8. Show the proper allocation of the superintendent's salary for the month of May.

EXERCISE No. 182, DISTRIBUTION OF POWER

Each machine in a factory is frequently equipped with an electric motor. There is no expense for power except during the time that the machine is running. This lessens the power expense, especially when some of the machines are idle for a considerable period. The cost of power, which is the amount paid for electricity used in operating the motors which operate the machines, should be allocated to each department. This allocation is made on a basis of productive hours and horse power (h.p.). If a machine

is not operating, the department will have fewer productive hours. The greater the horse power of a machine, the more electricity required to operate its motor.

$2 \times 500 = 1,000$ h.p. hours, Department A
 $7 \times 1,000 = 7,000$ h.p. hours, Department B
 $5 \times 800 = 4,000$ h.p. hours, Department C

 12,000 h.p. hours, Entire factory

$\frac{1,000}{12,000} \times \$100 = \$ 8.33$, Department A

$\frac{7,000}{12,000} \times \$100 = \$58.33$, Department B

$\frac{4,000}{12,000} \times \$100 = \$33.34$, Department C

 \$100.00, Total

Thus, if Department A has 2 h.p. with 500 machine hours, Department B, 7 h.p. with 1,000 machine hours, and Department C, 5 h.p. with 800 machine hours, and if the cost of the electricity is \$100, the distribution of the expense for power is found by the method illustrated at the left. The total number of h.p. hours used is found for each department and for the entire factory. The total power cost is then distributed by multiplying the total cost, \$100, by three fractions. The denominator of each fraction is the total number of h.p. hours, and the numerators of

the fractions are the number of h.p. hours for each department.

1. The Newman Printing Company has four departments, composing room, pressroom, bindery, and storeroom. The horse power of the machines in the composing room is 2; of those in the pressroom, 16; of those in the bindery, 6. For the month of October these departments had the following productive machine hours: composing room, 175; pressroom, 1,350; bindery, 1,075. The cost of the electric current used by these machines during the month was \$145.40. You are to allocate this cost to the departments.

2. The Mason Manufacturing Company pays \$224.50 for electricity used during the month of October. This amount is to be distributed to Departments A, C, D, and E. Department A requires 22 h.p.; Department C, 18 h.p.; Department D, 6 h.p.; Department E, 20 h.p. Department A had 1,200 productive hours; Department C, 1,600 hours; Department D, 1,100 hours; Department E, 1,400 hours. Show the charge to be allocated to each department as its share of the cost of the power.

3. The Davidson garage has four departments. Department A requires 3 h.p.; Department B, 18 h.p.; Department C, 12 h.p.;

Department D, 8 h.p. The cost of electricity used during the month of March in operating the machines was \$239.85. You are to distribute this amount over the four departments, assuming that the productive hours in the departments are the same.

4. The Fair Store, mentioned in Problem 4, Exercise No. 179, does not have machines operated by power, but does use electricity for lighting the departments. For the month of December the cost of electricity is \$97.20. This amount is to be allocated to the departments on a basis of the number of square feet in the departments. Show the proper allocation of this electric light cost over the six departments.

5. The Day Machine Shop has power machines in three of its six departments. Department No. 1 requires 22 h.p.; Department No. 4, 26 h.p.; Department No. 6, 12 h.p. The number of productive hours for August was as follows: Department No. 1, 2,125; Department No. 4, 1,645; and Department No. 6, 875. The cost of electricity for power was \$550.11. You are to allocate this cost to the three departments on a basis of horse power and productive machine hours.

EXERCISE No. 183, PROFIT ON SALES

The manufacturer, like the merchant, obtains a profit by selling merchandise for more than its cost and the operating expenses. The cost of the goods sold by the merchant is represented by the purchase price with such adjustments as may be necessary for inventories. The cost of the goods sold by the manufacturer is represented by the cost of the raw materials and by the manufacturing expenses.

The solution given on the following page shows the process of ascertaining the profit on the sales of the Grau Manufacturing Company for a certain year. The following facts are used: sales, \$85,608.40; inventory of raw material on January 1, \$9,421.87; purchases of raw material, \$32,982.50; inventory of raw material on December 31, \$9,455.80; labor, \$16,421.80; manufacturing expense, \$7,236.55; inventory of finished goods on January 1, \$3,450.75; inventory of finished goods on December 31, \$3,325.60.

As in the statement of profit and loss of a merchant, illustrated on page 258, the total sales are placed at the right so that the cost of the goods sold can be subtracted from them. The cost of the goods manufactured is then calculated by the method illustrated on page 274. To the cost of the goods manufactured is added the inventory of the finished goods on January 1 to show the total goods available for sale. From this total the inventory of

finished goods at the end of the year is subtracted. This shows the cost of the goods sold. The cost of the goods sold is then deducted from the total sales, the difference being the gross profit on sales.

Sales.....		\$85,608.40
Raw Material on Hand, Jan. 1.....	\$ 9,421.87	
Purchases.....	32,982.50	
Total Raw Material Available.....	42,404.37	
Less Raw Material on Hand, Dec. 31....	9,455.80	
Cost of Raw Material Used.....	32,948.57	
Labor.....	\$16,421.80	
Manufacturing Expense... 7,236.55	23,658.35	
Cost of Goods Manufactured.....	56,606.92	
Finished Goods Inv., Jan. 1.....	3,450.75	
Goods Available for Sale.....	60,057.67	
Less Finished Goods Inv., Dec. 31.....	3,325.60	
Cost of Goods Sold.....		56,732.07
Gross Profit on Sales.....		\$28,876.33

The following problems provide practice in ascertaining the gross profit on sales resulting from manufacturing and selling merchandise. You are to show all the calculations necessary to ascertain this information, arranging your work in the same form as that in the illustration.

1. The L. A. Brewer Manufacturing Company had on hand at the beginning of a certain business year raw material amounting to \$16,492.55. The value of the raw material purchased during the year was \$21,416.30. The cost of labor for the year was \$9,422.16, and the manufacturing expense was \$6,227.41. The inventory of finished goods at the beginning of the year was \$3,796.25. The inventories at the end of the year were: raw material, \$14,219.65; finished goods, \$3,950.70. The sales for the year were \$52,417.19.

2. The Morrison & Bloom Co. had on hand at the beginning of a certain business year raw material amounting to \$15,736.89.

The value of the raw material purchased during the year was \$23,786.34. The cost of labor for the year was \$8,963.45, and the manufacturing expense was \$5,890.37. The inventory of finished goods at the beginning of the year was \$3,621.58. The inventories at the end of the year were: raw material, \$13,589.67; finished goods, \$3,751.22. The sales for the year were \$53,987.32.

3. The following figures were taken from the books of the A. B. Sanford Company and are applicable to a period of five years:

	a.	b.	c.	d.	e.
Inv.....	\$32,514.91	\$30,327.62	\$38,109.30	\$40,487.22	\$29,161.80
Pur.....	63,421.90	67,236.80	66,721.91	55,304.09	70,134.50
Labor..	18,437.15	17,219.65	18,728.88	19,437.62	22,518.90
Mfg. Exp.	906.27	10,948.32	8,542.99	10,533.34	11,542.54
Sales...	127,962.44	135,518.72	141,432.98	129,786.55	139,963.27
Finished Goods	9,750.42	10,157.60	10,341.66	9,690.45	10,150.34

The beginning inventory in problem "a" is the amount given across from the heading "Inventory," and the ending inventory is the amount given in problem "b" across from the heading. The ending inventory for problem "e" is \$38,671.29. This applies also to the inventory of finished goods; the ending finished goods inventory for problem "e" is \$10,060.45. You are to ascertain the gross profit on sales for each of these years.

CHAPTER 55

PROBLEMS OF A FARMER

Farming is an occupation which requires the use of business principles as well as improved methods of production. The farmer is engaged in a business that produces commodities through cultivation and natural growth. Many of the problems of a farmer, which arise either in determining his own position or procedure or in making a check on the individual or the business with which he deals, may be solved by arithmetic. The solution of these problems requires a knowledge of the fundamental arithmetical operations and practices. Some of these have been illustrated in previous chapters; others will be described and illustrated in this chapter.

EXERCISE No. 184, COST OF PRODUCING FARM PRODUCTS

Items which may be included in the cost of farm products are: seed planted; labor used in preparing the ground for planting and in gathering the crop; feed for the horses, or gasoline and oil for the tractor or truck used in planting and gathering the crop; value of livestock purchased; labor used in tending livestock; feed for the livestock; insurance; taxes; depreciation of equipment; veterinary fees; threshing expense; and farm supplies, such as twine, fuel, fertilizer, etc., used in the farmer's operations.

At certain periods the farmer should determine the total cost of production of all his products raised for sale. He needs this

Cost of Corn Produced:		information to determine whether or not he is operating his farm successfully. He realizes that the lower the cost of production the greater will be his income from the sale of his products.
Seed Corn.....	\$ 16.25	
Man Labor.....	124.00	
Machine Labor.....	73.50	
Horse Labor.....	34.75	
Fertilizer.....	38.00	
Depreciation of Equipment.....	26.00	
Insurance.....	3.25	
Taxes.....	22.45	
Total Cost of Corn Produced.....	\$338.20	

The illustration on page 293 shows the method of ascertaining the cost of producing a corn crop, raised by a farmer who specializes in growing grain. The same elements would be used by a farmer in determining the cost of oats, tobacco, cotton, wheat, barley, or any other product produced from the soil or by natural growth.

The following problems provide practice in ascertaining the cost of production of farm products. Arrange your work in the same form as that in the illustration.

PRODUCT	SEED	MAN LABOR	HORSE LABOR	MA- CHINE LABOR	SUP- PLIES USED	DEPR.	INSUR- ANCE	
						OF EQUIP- MENT		TAXES
1. Wheat	\$ 8.40	\$45.50	\$12.80	\$32.00	\$ 4.25	\$18.40	\$28.00	\$1.75
2. Cotton	6.80	21.50	6.00	8.00	2.50	2.60	2.35	1.00
3. Oats	6.10	32.40	10.50	26.00	3.15	15.25	14.00	1.15
4. Tobacco	9.35	48.00	33.00		12.00	3.10	12.80	3.40
5. Barley	6.50	15.00	10.30	9.45	4.15	1.90	8.00	2.30
6. Potatoes	7.50	48.90	10.10	5.40	9.34	5.18	4.12	1.95

EXERCISE No. 185, PROFIT ON SALES

At certain periods the farmer will want to know his profit on sales. It may not be desirable for him to attempt to determine the profit on each sale, but he will determine his profit on all sales.

In order to secure this information, he must know the cost of his sales. If all the commodity produced during a certain period was sold during the same period, the cost of sales would be the cost of goods produced, as discussed in the previous exercise.

It is hardly probable that all goods produced during one period will be sold during that period. For this reason a part of the cost of the commodities produced during one period will likely be included in the cost of those sold during the next period. Likewise, it is necessary to know the cost of the goods which have been produced and are ready for sale but have not been sold and also the cost of those goods that are in process.

Those commodities which have been started in the process of production but which are not finished or ready for sale are said to be *in process*. The farmer plows his ground for wheat in the fall. If, on December 31, he wishes to determine his profit on sales, he must consider the total cost of plowing the ground for wheat as a part of the cost of the wheat harvested during the next year and not during the current year.

The commodities produced that are ready for sale and those that are in process when the cost of sales is determined are referred to as *inventories*. To the inventory at the beginning of the period is added the cost of the goods produced during the period. This amount is the total cost of the goods available for sale. From this amount is deducted the inventory at the close of the period. The balance is the cost of sales. The cost of sales subtracted from the total sales gives the *profit on sales*.

The illustration below shows the method of determining the profit on sales.

Livestock Sales.....		\$435.00
Cost of Sales:		
Livestock Inventory, January 2, 19—.....	\$129.00	
Cost of Livestock Produced:		
Livestock Cost.....	\$ 97.40	
Trucking Expense.....	16.20	
Feed.....	112.00	
Labor.....	21.00	
Miscellaneous Livestock Expense.....	4.25	
Total Cost of Livestock Produced....	250.85	
Livestock Available for Sale.....	379.85	
Less Livestock Inventory, Dec. 31, 19—...	55.00	
Cost of Sales.....		324.85
Profit on Sales.....		\$110.15

In the following illustration the cost of grain produced has been ascertained and shown in a separate statement.

Grain Sales.....		\$554.50
Cost of Grain Sold:		
Inventory of Grain in Process, Jan. 2, 19—	\$ 35.00	
Marketable Grain Inventory, Jan. 2, 19—	235.00	
Cost of Grain Produced.....	195.00	
Total Cost of Grain Available for Sale...	\$465.00	
Less: Inventory of Grain in Process,		
December 31, 19—.....	11.00	
Marketable Grain Inventory, De-		
cember 31, 19—.....	45.00	56.00
Cost of Grain Sold.....		409.00
Profit on Sales.....		\$145.50

In the following tables data are given for the year January 2, 19— to December 31, 19—. Find the profit on sales for each commodity. Arrange your solutions for Problems 1 to 4 in the same form as that shown in the first illustration on page 295; arrange Problems 5 to 8 in the same form as that shown in the second illustration on page 295.

Commodity	Sales	Begin- ning Inv.	Com- modity Cost	Labor	Miscellan- eous Expense	Final Inven- tory
1. Sheep....	\$148.00	\$105.00	\$32.00	\$ 6.50	\$2.00	\$38.50
2. Rabbits..	47.50	15.00	12.00	10.00	3.25	9.50
3. Hay.....	269.50	185.00	39.00	31.50	2.25	67.00
4. Oats.....	138.75	63.00	46.00	18.00	3.00	21.00

Commodity	Sales	Begin- ning Inven- tory— Market- able Com- modity	Begin- ning Inven- tory— Com- modity in Process	Cost of Pro- duction	Final Inven- tory— Market- able Com- modity	Final Inven- tory— Com- modity in Process
5. Wheat..	\$298.00	\$ 93.00	\$26.00	\$179.00	\$71.00	\$21.00
6. Rye....	82.50	21.00	11.00	39.00		13.50
7. Cotton..	425.00		50.00	350.00	50.00	60.00
8. Corn....	310.00	133.00	8.00	189.00	98.00	23.50

EXERCISE No. 186, NET PROFIT

There are certain expenses of every farmer that may not be considered as a part of the cost of production. These may include interest on money borrowed, telephone service, farm bureau dues (local, state, or national), subscriptions to farm magazines, loss due to fire or other damage, loss caused by uncollectible accounts receivable, etc. The effect of these expenses on the business operations is indicated by deducting them from the profit on sales. The balance is the net profit.

The illustration at the top of page 297 shows the calculation of net profit after the profit on sales has been ascertained.

Profit on Sales.....	\$405.75
Non-productive Expenses:	
Interest Expense.....	\$ 5.00
Farm Bureau Dues.....	22.00
Telephone Service.....	5.50
Magazine Subscription.....	3.50
Miscellaneous Expense.....	30.40
Total Non-productive Expenses.....	66.40
Net Profit.....	\$339.35

In each of the following problems find the total of the non-productive expenses, and the net profit. Arrange your work as in the illustration given above.

	Profit on Sales	Interest Expense	Farm Bureau Dues	Telephone and Telegraph Service	Magazine Subscrip- tions	Miscel- laneous Expenses
1.	\$ 872.50	\$ 14.30	\$15.00	\$31.75	\$3.50	\$ 42.80
2.	648.90		20.00	28.50	4.00	62.70
3.	1,242.35	175.25	18.00	42.60	3.75	124.30
4.	934.70	67.90	12.00	23.40	3.25	52.60
5.	756.40	35.72	10.00	18.50	2.50	27.90

EXERCISE No. 187, PRODUCTION EXPENSES

There are certain production expenses which, at the time they are incurred, might be charged to various products. The exact amount to be charged to each product, however, may not be known; hence, the total is recorded as a production cost, to be distributed on some equitable basis at a later date.

Examples of expenses of this kind are taxes, insurance, depreciation of the farm equipment used in producing the different commodities, depreciation of farm buildings, and farm supplies used.

The table at the top of page 298 represents an estimated distribution of production expenses on a percentage basis, over various products which are to be charged for their portion of these costs.

Production Expense	Poultry	Livestock	Grain	Dairy Products
Taxes.....	5%	40%	40%	15%
Insurance.....	10%	50%	30%	10%
Depr. of Farm Equip....	5%	10%	60%	25%
Depr. of Farm Bldgs....	12%	60%	12%	16%
Farm Supplies Used....	15%	50%	10%	25%

Distribute the production expenses listed below over the various products according to the percentages given in the table above.

	Taxes	Insurance	Depr. of Farm Equipment	Depr. of Farm Buildings	Farm Supplies Used
1.	\$120.00	\$30.00	\$225.00	\$150.00	\$110.00
2.	340.00	72.50	375.80	248.50	137.80
3.	210.00	47.80	249.75	198.40	124.35
4.	187.50	52.40	238.60	210.50	129.65

EXERCISE No. 188, FINANCIAL OPERATIONS OF A FARMER AND FARM MANAGEMENT

There are many problems of finance and management which the farmer may solve by arithmetic. He may be required to determine whether it would be more profitable to purchase a farm or to invest the money elsewhere. He may need to know the best methods of obtaining funds to pay his accounts.

The following problems provide practice in determining the best procedure the farmer should follow in the financial operations and management of his farm. Show all the calculations necessary to obtain your solutions.

1. Darwin Cly purchases a Farmall tractor from the Farmers Implement and Supply Company for \$800. The date of invoice is June 1; and the terms are 2/30, n/60. What amount should be given in payment of this invoice (a) on June 30? (b) on July 30? (c) If Darwin Cly can borrow sufficient money from the bank at 6% to pay this invoice on June 30, how much will he save by doing so?

2. Harold King was offered \$525 in cash as rent for his farm. He decided, however, to rent the farm on a profit-sharing basis. During the season his share of the expenses was: feed, \$250; repairs and replacements of tools and machinery, \$150; seed, \$25; and miscellaneous expenses, \$65. His share of the crop was sold for \$1,000. How much did he gain or lose through renting his farm on the profit-sharing basis?

3. Branch Oren owes the National Harvester Company \$652 on an invoice, the terms of which are 2/10, n/30. At the end of the ten-day discount period he is unable to pay the amount in full. He offers the National Harvester Company his check for \$500, provided it will allow him the same rate of discount that it would allow if he paid the account in full. What will he gain if the company accepts his check?

4. James Marsh can purchase a corn husker and shredder for \$830 on four months' time, or for \$800 in cash. If money can be obtained at 6%, which is the better offer?

5. Hershal McCammon has fallen heir to \$10,000. He has an opportunity to purchase a farm of 125 acres at \$80 an acre. This farm can be rented at \$8 an acre. His estimated annual expenses, incident to ownership, would be: taxes, \$150; insurance, \$35; depreciation of buildings, \$175; repairs, \$65. Which would be the better investment: to purchase the farm or to invest the \$10,000 in $4\frac{1}{4}\%$ nontaxable government bonds?

6. Marvin Kitchel is a tenant on a farm. During one year his income from the sale of his products was \$700 more than the cost of production and the operating expenses. He has an opportunity to purchase a 100-acre farm for \$10,000. It is expected that this farm would yield him \$950 more than the cost of production and the operating expenses. If he purchases the farm, he will have to withdraw from the bank \$4,000 which is now drawing interest at 4%, and he will have to borrow an additional \$6,000 for which he will have to pay interest at the rate of 6%. Should he purchase the farm?

EXERCISE No. 189, PRACTICAL MEASUREMENTS

The farmer is required to compute quantities of grain, hay, straw, and silage. He will be called upon to solve other problems

of measurements, such as those pertaining to the area of land or to the amount of fencing, time, etc. The following problems provide practice in applying practical measurements to farm problems. Show all calculations necessary to arrive at your solutions.

1. A farmer placed his wheat in two bins, each of which was 9 feet wide by 12 feet long. One of the bins was filled to a depth of 5 feet, and the other, to a depth of 6 feet. There are $1\frac{1}{4}$ cubic feet in a bushel. How many bushels of wheat did the farmer have?

2. Find the cost to enclose a field 80 rods long and 60 rods wide with a woven wire fence with a single strand of barbed wire on top. The posts cost $18\frac{3}{4}$ c each and are to be set 1 rod apart. The end posts will cost \$1.25 each; the barbed wire, $3\frac{1}{2}$ c a rod; and the woven wire, 38c a rod. The cost of digging the post holes, setting the posts, and stretching and fixing the wire, including the cost of staples, is \$34.65.

3. Harry Loveless, a farmer, wishes to know, for inventory purposes, the amount of silage in his silo. The silo is 16 feet in diameter. It was filled so that the silage was 26 feet deep after it had settled. A silo 16 feet in diameter has the following capacities: 12 feet: 33 tons; 14 feet: 41 tons; 26 feet: 97 tons; 32 feet: 131 tons. At the time the inventory was taken there was 12 feet of silage left. Find its amount in tons.

EXERCISE No. 190, FOUR-H PROJECTS

Boys' and girls' Four-H Clubs are found in practically every state which has an agricultural college. They are designed to teach through doing, and are organized to teach the finer things of rural life as well as better practices in agriculture and home economics. Many of their problems can be solved by the aid of arithmetic.

The following problems provide practice in ascertaining information desired by boys and girls engaged in Four-H Club work:

1. John Dailey, a member of the Four-H Potato Club, is undecided whether to use a fertilizer in his project. The cost of the fertilizer needed in his one-acre project is estimated at \$22.50; but the use of the fertilizer is expected to increase his yield 20%,

as well as the quality of the product. His yield without the use of the fertilizer will be 250 bushels. (a) How much greater income will he receive by the use of the fertilizer if potatoes of poor quality sell for 80c a bushel and potatoes of good quality sell for 95c a bushel? (b) What per cent will he increase his income by the use of the fertilizer?

2. If men and women of the farm, who have had experience as boys and girls, in Four-H Clubs, are able to increase their incomes on an average of 4% a year, how much will they receive annually if the average income of the farmer without this training is \$1,275?

3. Frank received \$19.20 as the income from his pig project. His cost and expenses amounted to \$14, not including a charge for his own labor. (a) What is the amount of his profit? (b) What per cent of his income is profit?

Frank spent twenty-one hours on the project. His labor is worth 20c an hour. (c) What is his labor cost? (d) How does this affect his profit?

4. Clark Long wishes to know the result of his Corn Club project. He had the following expenses: rent of ground, \$4.50; seed, 85c; fertilizer, \$5.35; expenses of plowing ground, planting, cultivating, and gathering crop, \$21.60; entry fee at county fair, \$3.50. His income was as follows: sale of 3 bushels of seed corn at \$1.75; sale of 97 bushels of corn on the market at 42c; second-place premium at county fair, \$4. (a) What was the total cost of his project? (b) the income? (c) the profit? (d) If he allowed himself 35c an hour for 38 hours spent on the project, how does this amount affect the profit?

5. Mary White, a member of the local Four-H Canning Club, borrowed \$75 from her sister for six months at 5% in order to finance her project. Her expenses were: purchase of 7 dozen cans at 95c a dozen; cost of vegetables and fruits used, \$12.18; entry fees at fair exhibits, \$4.50; transportation to exhibits, \$2.50; rent of special exhibit space, \$3.25. She received \$5 as a premium for fair exhibits and \$62.50 from the sale of her products to a local manufacturer for exhibit purposes. (a) Did Mary use good business judgment in borrowing the money for this project? (b) What was her profit or loss from the project after she repaid the money borrowed?

EXERCISE No. 191, COOPERATIVE MARKETING OF FARM PRODUCTS

Many farmers have organized associations for the purpose of cooperatively marketing their products. By this means they unite in an effort to handle their common interests through an agency controlled by them.

By uniting in the marketing of their products, farmers are able to lower their marketing cost and to increase the market price received by them. The income received from the sale of a product is the market price plus patronage refunds, which are based upon the amount of business done through the association.

An additional service is rendered the members of these associations in that they can purchase supplies which they need through the associations. These supplies may also be obtained from the local or state farm bureaus, organized for the benefit of the farmers. The cooperative association may be carried on under the direction of the farm bureau.

The following problems provide practice in solving problems pertaining to cooperative marketing associations and farm bureaus:

1. During March, John Sullivan delivered to the Producers Dairy Marketing Association 3,550 pounds of milk testing 4.3% butter fat. The association paid \$1.76 a hundred pounds for milk testing 4% butter fat. Twenty-five cents a hundred pounds was deducted for hauling expenses by the association. What did Mr. Sullivan receive for the milk?

2. The Allen County Livestock Cooperative Association received the following livestock for shipment:

From Harry Brown:	22 hogs—home weight, 4,250 lbs.
	10 roughs—home weight, 3,950 lbs.
From Paul Peabody:	20 hogs—home weight, 4,375 lbs.
	20 pigs—home weight, 2,110 lbs.
From Charles Baker:	5 hogs—home weight, 1,400 lbs.

Shipment was made to the Producers Cooperative Commission Association. The account sales rendered by it showed that the animals weighed as follows: hogs, 9,799 pounds; pigs, 2,062 pounds; roughs, 3,861 pounds. The hogs were sold for \$6.85 a hundred pounds; the pigs, for \$5.20 a hundred pounds; and the roughs, for \$5.10 a hundred pounds. The association deducted

the following expenses: yardage, \$8.50; fire insurance, 15c; freight, \$32.80; feed, \$9.40; and commission, \$15.10. Find the amount of net proceeds due the Allen County Livestock Co-operative Association.

3. What amounts are payable to Harry Brown, Paul Peabody, and Charles Baker by the Allen County Livestock Cooperative Association in the preceding problem, before the market and local expenses are considered? (It will be necessary to determine the average shrinkage of the entire shipment in ascertaining the amount due each of these men in payment of his hogs.)

4. The Marion Milk Association is organized on a cooperative basis. In one year it handles 45,499,998.5 quarts of milk. Two-thirds of the milk handled by it is sold to local customers at 10c a quart, and the balance is disposed of at a reduction of 30%. The operating expenses for the year are \$90,565. The association decides to set aside \$130,250 to pay certificates of indebtedness and interest and to establish a proper reserve. What amount will be paid the members of the association for their milk?

5. During one period the Porter County Cooperative Shipping Association made the following deductions from the income of producers in order to take care of the expense of operation:

Manager's Commission	\$4,437.69
Assistant Manager's Commission	2,152.40
Insurance	5,913.97
Associative Trucking	2,387.60
Local Car Expense	360.25
Miscellaneous Home Expense	817.80
State Association Dues	983.52

The actual expenses of the association for the same period were:

Manager's Commission	\$4,437.69
Assistant Manager's Commission	2,152.40
Insurance	411.36
Associative Trucking	1,892.80
Local Car Expense	259.50
Miscellaneous Home Expense	817.80
State Association Dues	983.52
General Expense	4,374.12

(a) Indicate, by means of a table, the items for which the deductions from income were more than or less than the actual expenses, and the amount of the difference in each case. (b) In the table show the amount by which all of the deductions from income were more than or less than the total expenses.

6. Loren Brown has four dairy cows. He sells his milk to the Cooperative Dairy Marketing Association. Cow No. 1 averages $49\frac{1}{2}$ pounds of milk daily; cow No. 2, 41 pounds daily; cow No. 3, 36 pounds daily; cow No. 4, 30 pounds daily. The price at which the milk is sold is \$1.58 a hundred pounds for milk testing 3.5. The price increases or decreases 4c for every tenth of a rise or fall in the test. The milk of Mr. Brown's cows tested 4.7 for the month of January. What was the total amount of his milk check for that month, if 25c a hundred pounds was deducted for hauling?

7. Assume that, in Problem 6, 10c a hundred pounds was deducted from each monthly check as a loan to the association, which had no capital. (a) What was the amount of Mr. Brown's check for January?

The association gave him a certificate of indebtedness, due in five years from date with interest at 6%, as acknowledgment of the loan for an entire year. (b) If Mr. Brown's milk averaged the same for each month in the year, what was the amount of his certificate? (c) How much interest did he receive each year? (d) How much was this certificate worth on the market at the time of issuance? at the end of the first year? at the end of the fourth year? (e) Was this certificate a good investment for Mr. Brown?

EXERCISE No. 192, MISCELLANEOUS PROBLEMS

1. A farmer can purchase a milking machine for \$111.80. The use of this machine will save 2 hours and 15 minutes of time worth 30c an hour. The cost of operating the machine will be 19c a day. How long will the machine have to be used before it pays for itself?

2. Adolph Johnson, a member of the local Four-H Calf Club, wants to know if the money invested by him in his project yielded a greater return than he would have received by leaving his

money in the savings bank. He invested \$15.50 of his savings in a feeder calf. His expenses for feed, labor, weighing, etc., were \$36.25. His net return from premiums at county and state fairs was \$17. He auctioned his second-prize steer at the state fair for \$78. His project terminated in six months. (a) If he received 4% on his money in the savings bank, did he gain or lose by withdrawing the necessary amount from his savings account? (b) What per cent did he receive on the money invested in his project?

3. How many tomato plants will be required for a plot of ground 88 yards by 110 yards if the plants are set 3 feet apart each way and if a half-yard border is left on each side of the plot?

4. A farmer was offered \$190 for his cotton crop before it was picked. He did not accept this offer, but he had the cotton picked and ginned before it was sold. He obtained eight 500-pound bales of cotton which he sold for $8\frac{1}{2}c$ a pound, and cotton seed which he sold for \$35. The expenses were \$12.50 a bale for picking, and \$5 a bale for ginning. How much did the farmer gain by having the cotton picked and ginned before it was sold?

5. Arthur Schlegel sold 36 hogs to the Farmers National Stockyards. The total weight of the hogs was 7,850 pounds. The hogs brought the top price for the day, \$5.30 a hundred pounds. How much did Mr. Schlegel receive for these hogs if yardage was 11c a head and commission was 27c a head?

6. A farm produces $\frac{1}{3}$ of a bale of cotton an acre. (A bale contains 500 pounds.) The cotton sells for 9c a pound. What is the owner's income from an acre if he receives as his share one-fourth of the income from the crop?

7. Hogs are worth \$5.25 a hundred pounds. If a bushel of corn costing 30c will cause a hog to gain 10.5 pounds, should the farmer sell his corn or feed it to his hogs?

8. Paul Gray produces 160 acres of corn. He uses a tractor, the cost of operating which is determined by the following information:

Yearly depreciation	\$90.00
Yearly interest	31.50
Repairs	36.00
Insurance	2.00

Housing	\$ 7.50	
Taxes	12.00	
Number of days used yearly	150	
Fuel used each day	15 gallons at 14c	
Oil used each day	$\frac{1}{2}$ gallon at 63c	
Grease used each day	$\frac{1}{4}$ pound at 20c	

The following operations are performed by the tractor. A daily labor charge of \$2 is made for each.

Plowing	17.4 days
Disking—twice	13 days
Planting	5 days
Rotary hoeing—twice	9 days
Cultivating—four times	20 days
Harvesting	11 days

Other costs are:

Seed	\$ 40.00
Hauling	110.00
Machinery	282.30

(a) If the yield is 40 bushels an acre, what is the cost of producing a bushel? (b) At what price should Mr. Gray sell his corn in order to realize a profit of 40% on his sales?

9. Fred Black drives a milk truck for the Indiana Dairy Marketing Association. He receives 26c a hundred pounds for hauling on an average of 2,650 pounds of whole milk to the plant each day. How much does he receive each day for hauling? each week? each month of 30 days?

Mr. Black's expenses are: gasoline and oil, \$32.50 a month; depreciation of truck, \$125 a year; garage storage, \$5.50 a month; tires and other expenses, \$144 a year. What does he receive a year for his labor and profit?

10. Fred Black, in the preceding problem, has purchased a new truck for \$1,250. He pays \$49.90 monthly on this truck. (a) Counting partial payment, if necessary, ascertain how long he must make payments. (b) What per cent of the price does he pay monthly?

He decides to hire a driver for the truck. He pays the driver \$14 a week. (c) How does this expense affect his profit for the year?

(d) If he considers his time worth \$18.50 a week, how much does he save each day by hiring a driver? each week? a year?

11. Ralph Martin, a farmer, pays \$10 a year as membership fees to the State Farm Bureau. Through the bureau he saved \$1.80 a ton on the purchase of eight tons of coal, his fuel for the winter; and \$1.70 an acre on the purchase of fertilizer. By pooling his wheat in the wheat pool controlled by the bureau, he received 8 cents a bushel more on 35 acres of wheat yielding 26 bushels an acre. What did he gain by belonging to the bureau?

12. A man who owns a small hay baler decides that he will hire three men at \$2.50 a day to help him operate the baler. It costs him \$4.50 a day for the teams to operate the baler. The repairs and replacement cost of the machinery are \$10 a day, and other expenses are \$2 a day. He can bale ten tons of hay a day. What must he receive a ton for baling hay if he is to make a profit of \$4 a day?

13. The truck drivers of the State Farm Bureau Oil Company work on a commission basis. Their trucks and other equipment are furnished by the company. The commission rates are .009 a gallon for gasoline, .007 a gallon for kerosene, and 17c a gallon for lubricating oil. Leren Bebout, a driver, sells on the average of 231 gallons of gasoline, 61 gallons of kerosene, and 12 gallons of oil daily. What are his daily wages?

14. Ackson Smith receives \$1.61 net for each one hundred pounds of milk. He sells on an average of 97 pounds a day. He can build a milk house for \$64, which will improve the quality of the milk and enable him to obtain \$1.72 a hundred pounds. How long will it require for the increase in income to pay for the milk house?

15. A farmer has a two-acre swamp in one of his fields, the outlet of which is 50 rods distant. The remainder of the field earns an average of \$11.50 an acre. The farmer wishes to cultivate this swamp. The cost of draining will include: tile at 86c a rod; digging, laying the tile, and filling in at 98c a rod. How long must this land be farmed before it will pay the cost of draining?

16. A farm produces twenty 500-pound bales of cotton which are sold at 9 $\frac{3}{4}$ c a pound. The owner receives one-fourth of the

income from the crop as rent. There are 45 acres in the cotton plot. He can sell the plot for \$100 an acre and lend this money at 5%. What is his gain if he keeps the land?

17. James Allison delivered to the local dairy marketing association 3,776 pounds of milk testing 4.2% butter fat. The association paid \$1.73 a hundred pounds for milk testing 4% butter fat. Twenty-three cents a hundred pounds was deducted for hauling expenses by the association. What did Mr. Allison receive for the milk?

18. John received \$22.50 as the income from his project. His cost and expenses amounted to \$15, not including a charge for his own labor. (a) What is the amount of his profit? (b) What per cent of his income is profit?

John spent twenty-two hours on the project. His labor is worth 21c an hour. (c) What is his labor cost? (d) How does this affect his profit?

19. A farmer placed his wheat in two bins, each of which was $8\frac{1}{2}$ feet wide by 11 feet long. One of the bins was filled to a depth of $5\frac{1}{2}$ feet, and the other, to a depth of 7 feet. There are $1\frac{1}{4}$ cubic feet in a bushel. How many bushels of wheat did the farmer have?

20. A farmer can purchase equipment for \$960 on four months' time, or \$900 in cash. If money can be obtained at 5%, which is the better offer?

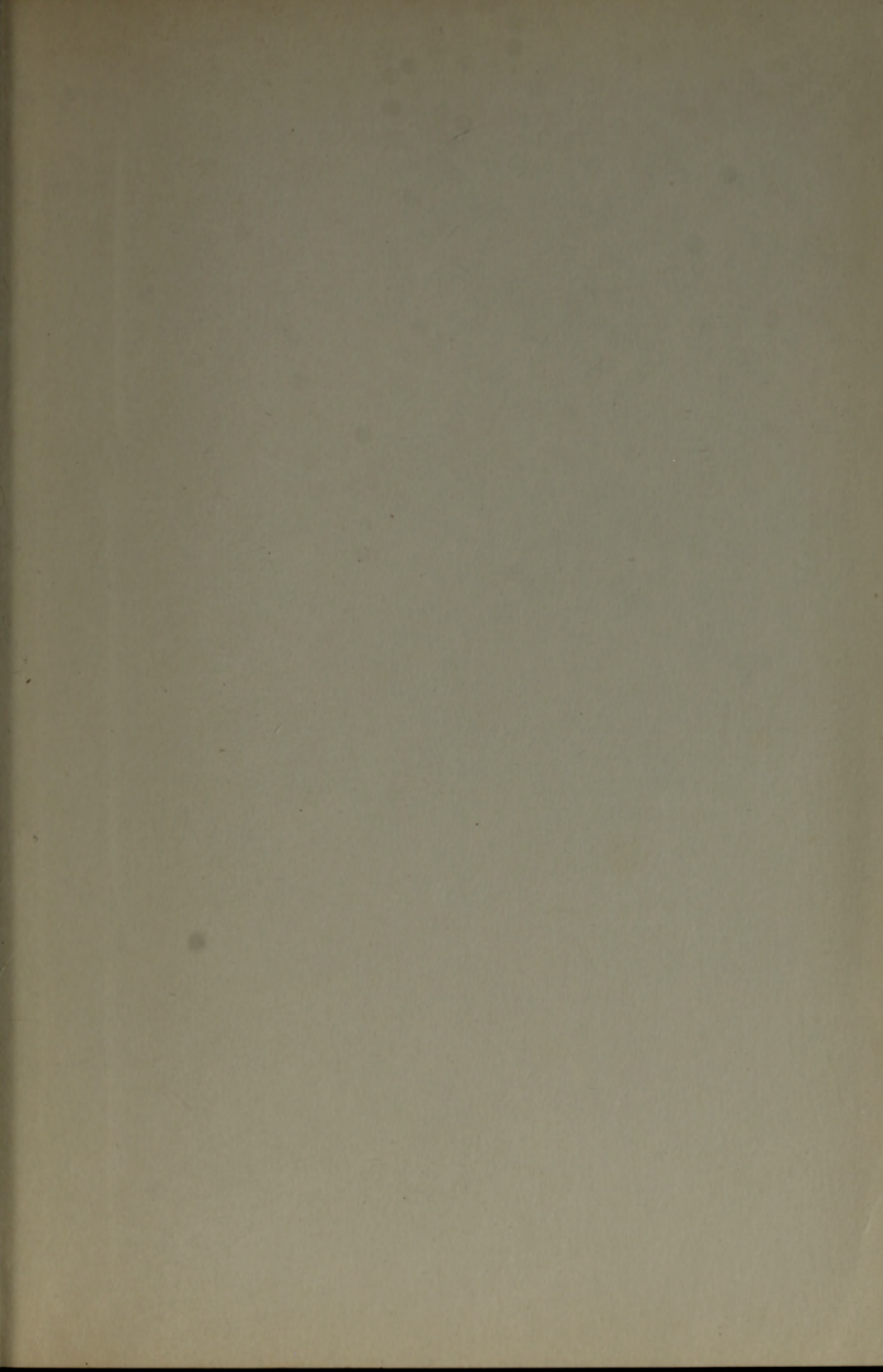
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BUSINESS

GU

100

List Price 100%

Amount Credited is always 100%

Notes Value

Face

Present Value

Maturity Value

2 Interest problems

proceeds of 100% in the

" " interest bearing rate

first either loan or discounted rate

either draft or trade acceptance

2240 - long ton

1st year is base

denote by of figure

Percentage = Base = Rate

Percentage = Rate = Base

Base x Rate = Percentage

expressed in same terms

$$P \cdot \frac{R}{100} = B$$

$$B \times \frac{R}{100} = P$$

Base is always the whole
Rate is always the whole
expressed as %

